This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

LANE MEDICAL LIBRARY STANFORD
L75 .W97 1871 STOR
Medical thermometry, and human temperatu
24503418003

LANE

MEDICAL LIBRARY

LEVI COOPER LANE FUND

LIBRARY

Cooper Medical College

DATE Jany 1902

NO. 5326 CLASS 13.

GIFT OF

Dr W. H. Newell

W965

Presented to
Lane Library
by [redacted] WM. H. NEWELL.

MEDICAL THERMOMETRY,

AND

HUMAN TEMPERATURE.

BY

C. A. WUNDERLICH,

PROFESSOR OF CLINIC AT THE UNIVERSITY OF LEIPZIG, ETC., ETC.

AND

EDWARD SEGUIN, M.D.

LANE LIBRARY

LANE MEDICAL LIBRARY
5326
SAN FRANCISCO

NEW YORK:
WILLIAM WOOD & COMPANY, 27 GREAT JONES STREET.
1871.

TO

DR. EDWARD CONSTANT SEGUIN,

LATE SURGEON U. S. V.,

LECTURER ON DISEASES OF THE NERVOUS SYSTEM IN THE NEW YORK COLLEGE OF PHYSICIANS AND SURGEONS;

ASSISTANT PHYSICIAN TO THE STRANGERS' HOSPITAL;

PHYSICIAN TO THE CITY HOSPITAL FOR THE PARALYTICS AND EPILEPTICS, ETC.

MY DEAR SON,

As you are one of the young medical men who have given their night and day cares to the introduction of Thermometry in the New York Hospital, it is with a double sense of justice and of paternal satisfaction that I dedicate to you this work of my old age.

E. SEGUIN.

NEW YORK, 1*st October*, 1871,
58 WEST TWENTY-SIXTH STREET.

Entered according to Act of Congress, in the year 1871, by
WILLIAM WOOD & CO.,
in the office of the Librarian of Congress, at Washington, D.C.

THE NEW YORK PRINTING COMPANY,
205, 207, 209, 211, *and* 213 *East Twelfth Street.*

W97
1871

PART THE FIRST.

ON THE

TEMPERATURE IN DISEASES:

A MANUAL OF

Medical Thermometry.

BY

PROFESSOR C. A. WUNDERLICH.

ABRIDGED BY

EDWARD SEGUIN, M.D.

TABLE OF CONTENTS.

DR. WUNDERLICH'S TREATISE.

		PAGE
Preface,		vii
CHAPTER		
I.	History,	1
II.	Fundamental Principles,	11
III.	Value of Thermometry in Medical Practice,	24
IV.	The Art of Medical Thermometry,	26
V.	On the Temperature in Health,	29
VI.	Causes of Altered Temperature in Disease,	37
VII.	Local Alterations of Temperature in Disease,	47
VIII.	Typical Forms with Altered Temperatures,	51
IX.	Diagnostic Value of Single Observations,	59
X.	Daily Fluctuations of Temperature in Diseases,	72
XI.	Course of the Temperature in Febrile Diseases,	80
XII.	On the Temperature in Special Diseases,	115
	§ I. Typhoid Fever,	117
	§ II. Typhus,	137
	§ III. Relapsing Fever,	141
	§ IV. Variola (Small-pox) and Varicella,	143
	§ V. Measles,	145
	§ VI. Scarlatina,	148
	§ VII. Rubeola,	150
	§ VIII. Erysipelas,	150
	§ IX. On a Peculiar Remittent Fever,	152
	§ X. Febricula and Traumatic Fever,	152
	§ XI. Pyæmia,	154
	§ XII. Catarrhal Affections of Mucous Membranes,	155

CHAPTER PAGE

§ XIII. Croupous and Diphtheritic Inflammations, . . 156
§ XIV. Pneumonia, ... 157
§ XV. Amygdalitis (Quinsy), ... 163
§ XVI. Parotitis (Mumps), ... 164
§ XVII. Meningitis, ... 164
§ XVIII. Pleurisy, Endo- and Peri-carditis, and Peritonitis, . 166
§ XIX. Acute Rheumatism, ... 167
§ XX. Osteo-myelitis, ... 171
§ XXI. Nephritis and Bright's Disease, ... 171
§ XXII. Hepatitis and Yellow Fever, ... 172
§ XXIII. Lues (Constitutional Syphilis), ... 172
§ XXIV. Glanders and Farcy, ... 174
§ XXV. Acute Miliary Tuberculosis, ... 174
§ XXVI. Acute Phthisis, ... 175
§ XXVII. Trichinosis, ... 179
§ XXVIII. Malarious Diseases (Ague, etc.), ... 179
§ XXIX. Cholera, ... 181
§ XXX. Injuries of the Spinal Cord, ... 184
§ XXXI. Neuroses, ... 185
§ XXXII. Chronic Disorders of Blood, Tissues, and Secretions, 185

XIII. On the Effects of Altered Temperatures on the System, . 190

PREFACE.

For the last sixteen years my attention has been uninterruptedly directed to the course pursued by the temperature in diseases of various kinds. I have gradually brought together a mass of notes which comprises many thousand complete cases of thermometric observations of diseases, and millions of separate readings of the temperature. The more my observations multiplied the more firm my conviction was of the value of this method of investigation. And though theoretical questions as to human temperature and kindred subjects must not be overlooked, my purpose has been to prepare from these notes a *practical* book.

A knowledge of the course of temperature in disease is indispensable to medical practitioners.

Because: all the phenomena of the sick are deserving of study. The temperature may be determined with a nicety which is common to few other phenomena. The temperature can neither be feigned nor falsified. We may conclude the presence of some disturbance in the economy from the mere fact of altered temperature. Certain degrees indicate that there is fever. The height of the temperature often decides both the degree and the danger of the attack. Thermometric observation may aid in the discovery of the laws regulating the course of certain diseases. When once the normal course of certain diseases has been determined, thermometry is able to simplify and confirm the

diagnosis. Thermometric investigations indicate rapidly and surely any deviation from the regular course of a disease. The behavior of the temperature during the progress of the disease discovers either relapses or ameliorations before they could be otherwise recognized. In this way thermometry is able to regulate therapeutics. It puts us on our guard against any injurious influence that may affect the patients in the course of their illness. It serves to indicate the transition from one stage of the disease into another, and particularly the commencement of convalescence and its complete establishment. It reveals complications, and how far recovery is from being complete. It generally reveals the imminence of a fatal termination. It announces the impossibility of the continuance of life. It furnishes certain proofs of the reality of death, when this is otherwise uncertain.

If I succeed in diffusing the truth of these propositions, I will have enabled my medical brethren to discover the real value of thermometric data, and the object of my work will be attained.

LEIPZIG, March, 1868. DR. WUNDERLICH.

CHAPTER I.

HISTORY.

In the earliest ages of medicine the significance of temperature as a symptom in disease was fully recognized. By Hippocrates heat was deemed the chief diagnostic sign of acute diseases; and the Greek and Latin names for fever signify elevation of temperature.

After centuries of apparent neglect of temperature as a factor in disease, Sanctorius (professor at Padua, 1600 to 1636) applied a thermometer of his own invention to the determination of human temperature. Sanctorius pleaded the concordant importance of the determination in disease of "temperature" and "body-weight" (to measure which he also invented a weighing-chair). After him Boerhaave and Van Swieten were the first known to have attached a clinical importance to temperature. But to de Haen, of Vienna, belongs the honor of having introduced thermometry in the practice and teaching of medicine.

Experience had led de Haen to leave the thermometer *in situ* seven and a half minutes, and to add one or two degrees Fahrenheit to the registered temperature. However imperfect this method, it afforded him valuable data, which have been confirmed—even rediscovered since. His thermometrical labors are dispersed through the fifteen volumes of his "Ratio Medendi."

De Haen observed the temperature of healthy people of various ages, and was the first to remark the high temper-

ature of the aged. In various parts of his work are proofs of his application of thermometry to diagnosis and prognosis. He was aware of the morning remission and evening exacerbation of temperature in fevers; of the rise of temperature during the febrile rigor (fieber frost); of the persistence of fever-temperatures after intermittent fevers have apparently been cured; and of the discrepancies between pulse and temperature in some patients and in certain diseases; he knew the contrast between the subjective feeling of warmth or cold as felt by the patient, and the objective temperature *as per* thermometry; he used the changes of temperature as therapeutical means; and regarded the return to normal temperature as a proof of convalescence. He advocated his own theories on animal heat with considerable perseverance and ardor.

In spite of his great fame, the discoveries of de Haen were neglected, and medical thermometry once more abandoned after his death.

In England Ch. Martin published the first accurate observations on temperature in healthy men and animals, "De Animalium Calore, 1740." The followers of Haller experimented in various directions upon human temperature, and Blagden discovered the notable fact that an ambient temperature of 212° Fahr. cannot sensibly modify the vital temperature of a healthy man.

John Hunter began (1775–78) to publish his experiments on temperature in the *Philosophical Transactions;* and was the first to remark the local elevation of temperature in inflammation, after an operation for hydrocele.

Shortly after, the celebrated work "Sur la Chaleur" (Mem. de l'Académie, 1780) was published in France by Lavoisier, the discoverer of oxygen and the father of modern chemistry. In collaboration with Laplace—himself second to none—he investigated the causes of animal

heat, and attributed it to the chemical combinations of oxygen with hydrogen and carbon in respiration. He says: "The animal machine has three regulators: respiration, which consumes hydrogen and carbon and produces heat; transpiration, which, according to the necessities of the case, lowers the temperature and cools the body; and digestion, which restores to the blood what it has lost." He places the seat of warmth-production (combustion) in the lungs.

Crawford ("De Calore Animalium," 1779–86) seeks the source of heat in the chemical processes in the lungs, and tried to explain the pathological changes of temperature and the local temperature of inflamed parts.

James Currie published in 1797 "Medical Reports on the Effect of Water, Cold and Warm, as a Remedy in Fever and other Diseases." For the first time since de Haen the observation of temperature was by him made available for medical purposes, and especially as a means of controlling therapeutic experiments. Each case has its temperature recorded; thermometry pervades the whole of Currie's practice; nevertheless, it influenced very little the medical profession. Vacca Berlinghieri, Buntzen, Coleman ("Dissertation on Suspended Respiration," 1791), and Saissy ("Recherches sur la Physique des Animaux Hybernans," 1808), added some interesting facts. Sir B. Brodie published, in 1811, "Some Physiological Researches respecting the Influence of the Brain on the Action of the Heart, and on the Generation of Animal Heat," and "Further Experiments" on the same subject, in *Philosophical Transactions*, 1812, p. 378. Dalton and John Davy opposed his views on the source of animal heat; Nasse and Earle supported Brodie. The labors of Hale and Legallois also deserve a mention here.

Chossat (Thèse, Paris, 1820), "Sur l'Influence du

Système Nerveux sur la Chaleur Animale," supported by a great number of experiments the opinion that "the source of animal heat was to be sought in the sympathetic nerve." In the course of the discussion which followed this important paper, Dulong and Despretz (1822–23) decided in favor of Lavoisier's theory. At the same time Gentil observed the variations of temperature according to age, sex, temperament, etc.; and Thomson the production of heat in an inflamed part (in Meckel's *Archives*, v. 405).

In 1821 Hufeland offered a prize for the demonstration of Currie's theory and method of treatment. The prize essays of Anton Frölich and Reuss (published in Hufeland's Journal, 1822) contain many valuable contributions to pathological thermometry. Bailly wrote a "Mémoire sur l'Altération de la Chaleur Animale dans les Fièvres Algides" (*Revue Médicale*, 1825, v. 384); and Edwards (1824) in "De l'Influence des Agents Physiques sur la Vie," gave a *résumé* of all that was then known about temperature.

These thirty years gave few methodical and comprehensive results of temperature in health or in disease. But a new era opened in 1835, when Breschet and Becquerel published their researches on human temperature (in *Annales des Sciences Naturelles*, Zoologie, tom. iii., iv., et ix.). Although they regarded pathological conditions but slightly, they tested the variations of temperature in different parts of the bodies of men and animals by means of extraordinary sensitive thermo-electric apparatus. They found the temperature of inflamed parts higher than that of the healthy ones; and established the mean healthy temperature of man at 36·9° Centigrade=98·5° Fahr. [This was the corner-stone of the new edifice, Medical Thermometry.—E. S.]

Another production of great merit, but with no patho-

logical bearing, was the Zoo-physiological treatise of Berger, determining the temperature in various species of animals, "Faits Relatifs à la Construction d'une Échelle de Degrés de la Chaleur Animale" (in *Mémoire de la Société de Genève*, tom. v., part 2, tom. vii., part 1). Edwards furnished a comprehensive article in Todd's Cyclopedia, vol. ii., p. 648, 1836–39. Collard de Martigny published in 1836: "De l'Influence de la Circulation Générale et Pulmonaire sur la Chaleur du Sang." P. H. Bérard wrote in the article "Warmth," of the Medical Dictionary, in 32 vol., the physiological part, and Chomel the pathological. Bouilland and Donné used thermometry in their practice. Piorry had a thermometer added to his stethoscope, urged the necessity of even measuring the temperature of the skin, and strengthened the claim of the thermometer by repeating this prophetic utterance of Biot: "Lorsqu'on voit tant de résultats obtenus par le seul secours d'un peu de mercure enfermé dans un tube de verre, et qu'on songe qu'un morceau de fer suspendu sur un pivot a fait découvrir le Nouveau Monde, on conçoit que rien de ce qui peut agrandir et perfectionner les sens de l'homme ne doit être pris en légère considération."

In 1837 Sir B. Brodie made known his experiments "On the Elevation of the Temperature after the Division of the Spinal Cord, etc." (*Med. Chir. Transact.*, vol. xx., p. 118). Wistinghausen, Fricke of Hamburgh, and Friedrich Nasse furnished valuable contributions at the same time (1839) that Gavarret confirmed (in the Journal l'Expérience) several of the almost forgotten discoveries of de Haen.

About 1840 thermometry took a new start when Andral, the then leader of progress, applied it, like Currie, not only to individual cases, but to "map out the courses of temperature, and to find out their laws." Still more valu-

able than Andral's "Lectures on General Pathology," was the "Dissertation" of Gierçe, "On the Causes of Organic Heat in Inflamed Parts." Hollman made many observations "On the Variations of Temperature in the Healthy, under various conditions and circumstances;" and Chossat completed his "Experimental Researches on Inanition." Of the same date are the investigations of Henri Roger (De la Température chez les Enfants, à l'état Physiologique et Pathologique" (Arch. Gen. 1844, and since in book form), still highly valued. His thermometrical observations bear on the normal temperature of children at birth, during their first seven days, and later; then in ephemeral, intermittent, typhoid fevers, small-pox, scarlatina, measles, erysipelas, rheumatism, pericarditis, cardiac hypertrophy, stomatitis, enteritis, dysentery, meningitis, encephalitis, laryngitis, bronchitis, pleurisy, and pneumonia; and further in tuberculosis, whooping-cough, chorea, dropsies, rickets, and paralysis, besides thrush and sclerema of newly-born infants. Finally, Dr. Roger sums up, in a practical manner, the result of these observations in diagnosis and prognosis. Such a wealth of thermometric facts had never been accumulated before, and though open to criticism, it contains many fine observations, and offers summaries and deductions which are still interesting.

Demarquay (1848, *Archives Générales*) investigated the influence of pain, loss of blood, ligature, toxic agents, etc., on the temperature of animals; and, conjointly with Dumeril, published "Experiments on the Lowering of Temperature by Ether and Chloroform."

Zimmermann, a military surgeon, advocated the cause warmly, and furnished a great number of valuable facts. The dissertation: "De Calore in Morbo," Bonn, 1849, of T. P. Schmitz, will not be forgotten, nor the teachings of Nasse on the same subject. Let us supplement these brief

mentions by an acknowledgment of the value and abundance of the thermometric observations of John Davy, which successively appeared from 1844 to 1863. He gave special attention to "The Temperature of Healthy Persons" as a basis for other observations: The temperature in advanced age; influence of the external temperatures on animal heat; diurnal fluctuations; influence of seasons, of active and passive exercise, of concentrated attention, of increased alimentation, of sea-sickness, etc., on temperature; with comparisons of the same in tropical and northern climates; and many subjects of lesser importance treated incidentally.

About 1846, chemists and physiologists took up the question—Fourcault, Flourens, Magendie, Helmholtz; Donders treated of "The Tissue Changes as a Source of Heat in Plants and Animals;" Liebig referred the ultimate source of heat to chemical processes, and especially to slow combustion, and thus extended and fortified the doctrine of Lavoisier.

After this, it was only necessary for physicists to complete the idea of "temperature," and its applications to physiology and pathology would follow as a matter of course. More or less directly, three or four men did it. First, J. R. Mayer, of Heilbronn, declared (1842–45) the essential "unity of the so-called imponderables," by which the chemical processes which appear, as, light from the sun, disengagement of heat, mechanical motion, electric affinities, etc., are converted into a single force or power. This doctrine of the "unity and correlation of forces" was a perfectly new idea: *Ex nihilo nil fit, nil fit ut nihilum.* "The effect equals the cause: the operation of force is again force in its turn. In truth, there is but one real force which runs through an eternally changing round in dead as in living Nature. There, as here, there

is no progress, unless the force changes its form. Heat is a force, it becomes changed into motion. Chemical difference is a force, the changing of chemical difference into heat results from combustion. In all chemical and physical changes the given power always maintains a constant magnitude. The sole cause of animal heat is a chemical process, a kind of oxidation. The chemical force which it contained in the food ingested and in the oxygen inhaled, is the source of two manifestations of power, viz., motion and warmth; and the sum of the physical power of any animal is equivalent to that of the simultaneously produced chemical processes." Mayer made application of this theory to some pathological, and to many physiological phenomena.

This *Novum Organum* was too much for the medical public, who needed the authority of Helmholtz to pay it any attention. To Joule, of Manchester, belongs the honor of having experimentally demonstrated the absolute and unchangeable relation between heat and mechanical power; and of having shown that a given quantity of power produced a determinate quantity of heat; conversely, that the quantity of heat which would raise a given quantity of water one degree, would (if otherwise applied) perform exactly an equivalent amount of mechanical work. In other words, the heat capable of increasing the temperature of one gramme of water by 1° C. is equivalent to a force represented by the fall of 423.55 grammes through the space of one metre. This is consequently the effect of *a unit of heat.* (W. B. Woodman, translator of the new Sydenham Society edition of this book.) Finally, Hirn, of Colmar, showed, with mathematical positiveness, that, whilst at work, the production of heat never corresponded to the oxygen consumed; much of it being changed into work: instead of the missing

heat, so much work was done. This can give but a faint idea of the influence exercised by Dr. Mayer's theories of warmth-production. Physiologists and pathologists received from them a lasting impulse, since henceforth the temperature of the body became like all others, a force convertible, *i. e.*, manageable and subject to laws.

Bärensprung and Traube, in 1851, began the new and henceforth endless series of pathologists who mainly founded diagnosis, prognosis, and, to a certain extent, therapeusis upon thermometric observation.

Ever since October, 1851, I myself, induced by Traube's spoken recommendations, have introduced the use of the thermometer in my clinic. The number of cases thus studied amounts to nearly 25,000, and the number of single observations to some millions. When the number of the latter reached 100,000, they appeared to me capable of serving as a basis for the determination of this most decisive question of pathology: Do certain diseases in their progress obey fixed laws or rules, and can this be determined and displayed by the course of the temperature? The affirmative answer was first afforded by the thermometric observation of typhoid fever, and by the occurrence of a short epidemic of typhus.

In these and subsequent labors, I have been helped by a host of faithful assistants, who worked day and night with scientific devotion, and have (some of them in their turn) elucidated important questions. My thanks to all of them, and particularly to Drs. Thierfelder, Uhle, Friedemann, Rotter, Nakonz, Geissler, Siegel, Wolff, Bloss, Thomas, Schenkel, Triebmann, Friedlander, Heinze, Heubner, Stecher, and Hankel.

[With regret, indeed, I stop here the history of the progress of thermometry, and leave off the rich bibliography collected by the author and by his English translator, Dr.

W. B. Woodman. But in the ungrateful task of shortening a book, a conservative line must be drawn somewhere, and I draw mine where the labors of the great thermometrician begun. I would have liked to do justice to the English observers, trusty Sydney Ringer, systematic Aitken, the inventor of the self-registering thermometer; J. Simon, Grimshaw, W. Ogle, E. Long Fox, etc.; to the disciples of the Viennese Traube and of the great Prussian; to the equally great American, Benjamin Thompson, Comte de Rumford, who, first of all men, demonstrated in 1792 the identity of movement and caloric; to Bennett Dowler and I. S. Lombard, well known, and L. Bulkley (who deserves to be known), as representatives of medical thermometry in this country; to the men who resuscitated scientific Italy, Maurice Schiff, Paolo Mantagazza, etc.; to Berthelot, Charcot, Dupuy, Gavarret, Levier, Marey, Marcet Jaccoud, Onimus, Bouvier, Vulpian, and most particularly to Brown-Séquard, omnipresent wherever Progress calls for Genius. But I have hardly room to thank Wunderlich for the dangerous honor he did me of writing my name among those of the promoters of thermometry; and for begging to be forgiven the unavoidable mistakes I may make in trying to abridge a book which is itself an abridgment of many volumes.—E. S.]

CHAPTER II.

FUNDAMENTAL PRINCIPLES.

§ 1. Two facts justify the physician in using the thermometer everywhere, the invariability of the temperature in healthy persons, and its variations in disease.

§ 2. The average temperature taken at the axilla, or in any other artificial cavity, is 98.6° F.=37° C.=Zero-health of the medical thermometer (see second part); and higher by some tenth of a degree in the natural cavities.

[In England the NORME is 98.4° F.; in France, 36.9° C., where Brechet had the glory of establishing it. Till these discrepancies shall be demonstrated to correspond, or not, to important facts of race or climate, we have no right to infirm them, but we have to signalize the necessity of their final verification as one of the most important objects of the future investigations on thermometry.—E. S.]

§ 3. The temperature of healthy persons is almost constantly the same; its oscillations in the course of a day seldom exceed $\frac{1}{2}$° Cent.=$\frac{1}{10}$° Fahr. (unusual conditions excepted). "The maintenance of a normal temperature under varying conditions, or, in other words, a constant temperature in any individual, is a proof of a sound constitution."

§ 4. A normal temperature does not necessarily indicate health; "but all those whose temperature either exceeds or falls short of the normal range, are unhealthy."

§ 5. The range of temperature in severe diseases is between 35° C.=95° F. and 42.5° C.=108.5° F., and very

seldom falls below 33° C.=91.4° F., or rises to 43°C.= 109.4° F., though in rare cases it has reached 44.75° C.= 112.55° F.

§ 6. Deviations from the normal course of temperature never occur without causes or fixed "laws;" that is the foundation of "Pathological Thermometry." We sometimes fail to discover these laws, because in disease, more than in health, the temperature of the body is the result of mutually antagonistic factors.

§ 7. Influences which in no way disturb the temperature of the healthy, derange that of the sick, even if they hardly affect his sickness. "Mobility of temperature under the action of external influences is, therefore, a sign of some diseased condition of the body." Therefore the discovery of abnormal temperatures in men previously healthy is a means of discovering or confirming the existence of a latent disease.

§ 8. Alterations of temperature may be confined to special regions, whilst the rest of the body remains almost normal; they seldom exceed 1° C.=1.8—2° F.; but are accompanied by other obvious phenomena more useful for the diagnosis than the local abnormality of temperature.

§ 9. The general temperature is the "expression" of several processes, some tending to the production of heat, others to its exhalation. However varied is the combination of these processes, their thermal result, or the specific heat of the body, remains the same in health; and its variations in disease, though not absolutely trustworthy, are yet the safest standard by which to estimate the condition of the whole body. Variations of temperature coincide with other functional and structural disturbances not so easy to measure, and often appear long before other morbid alterations can be recognized.

§ 10. The heat of the whole body may be normal,

increased or diminished, whilst that of separate regions is different. "A normal temperature in sickness is only a relative sign," which may exclude certain forms of disease, but cannot by itself found a sure diagnosis. "A fall of temperature below the normal range" occurs temporarily, favorable or not. "An unequal distribution of animal heat" is unfavorable. "Abnormal deviations" furnish the best elements of diagnosis and prognosis.

§ 11. Certain abnormal temperatures are generally associated with a type of ill-health. A rapid increase in the heat of the body, and decrease of the heat of the extremities, is associated with "cold shivers," "rigors," "fever-frost." A protracted temperature of 38.5° C.=101.3° F., or more, is usually accompanied with heat, lassitude, thirst, headache, frequency of pulse; if persisting with diminution of body-weight, "pyrexia," fever, fever-heat. Any considerable diminution of warmth in the extremities, with very high or very low central temperature, is expressed by a small pulse, sunken features, weakness, nausea, cold sweating: collapse.

§ 12. The "amount" of temperature changes, their "relation" to one another, and their subsequent "alterations," are commonly determined by the course of the disease; so that, the more typical the disease, the more typical is the alteration of temperature. In opposition to these types are the atypical diseases in which the temperature, too, is irregular. Between them stand the affections, whose types and temperatures are not sharply defined.

"The typical diseases," which hardly deviate from their type, are illustrated by typhoid fever, typhus (apparently), relapsing fever, small-pox, measles, scarlatina, lobar pneumonia, and recent malarious fevers.

"The approximately typical diseases," which exhibit great regularity in certain stages, and none in others, are

exemplified by febricula, pyæmia, septicæmia, varicella, rubeola, facial erysipelas, acute catarrhal inflammation, tonsillitis, acute rheumatism, basilar meningitis, meningitis of the convexity, cerebro-spinal meningitis, parotitis (mumps), pleurisy, acute tuberculosis, fatal neuroses in their last stage, and trichinosis.

"Another group" is formed by those diseases which generally run their course without fever; but which display a regular type whenever fever supervenes. To this group belong cholera, acute phosphorus-poisoning, acute fatty degeneration, and syphilis. Even diseases designated as atypical exceptionally show an approximation to some type, as diphtheria, dysentery, pericarditis, peritonitis, acute and chronic suppurations (abscesses), and phthisis.

§ 13. A temperature is "monotypical" or uniform, as a rule; but in special cases it becomes "pleotypic," or multiform. Thermometry finds out these variations, which have enabled us to differentiate various types in the same disease. Thus, small-pox, typhoid fever, scarlatina, pneumonia, and malarious fever may assume the pleotypism that thermometry alone can demonstrate.

§ 14. Any disease, however fixed may be its type, may exhibit deviations from it (irregularities). These are circumscribed and determinate; thermometry alone can assign their extent and their form, and predict the time when the irregular course will reassume the typical form.

§ 15. A single observation of an abnormal temperature (however great or small may be the deviation from the norme), is not by itself conclusive as to the kind of disease present. All we learn is this: That the patient is really ill. When there is considerable elevation of temperature, we know there is fever. With extremes of temperature, we know there is great danger.

This is the "abstract significance" of a single observation.

"Temperatures much below" 36° C.=96.8° F., are "collapse" temperatures. Below 33.5° C.=92.13° F., deep, fatal algide collapse; 33.5°—35° C.=92.3°—95° F., algide collapse with great danger, still with possibility of recovery; 35°—36° C.=95—96.8° F., moderate collapse, in itself without danger.

"Normal or almost normal temperature," 36°—36.5° C. =96.8°—97.7° F., sub-normal temperatures; 36.6°—37.4° C.=97.88°—99.12° F., really "normal" temperatures; 37° C.=98°.6° F., the NORME; 37.5°—38° C.=99.5°—100.4° F., sub-febrile temperatures.

"Febrile temperatures," 38°—38.4° C.=100.4°—101.12° F., slight febrile action; 38.5°—39° C.=101.3°—102.2° F., in the "morning," rising to 39.5° C.=103.1° F., in the "evening," moderate fever; 39.5° C.=103.1° F., in the "morning," and about 40° C.=104° F., in the "evening," considerable fever; 39.5° C =103.1° F., in the "morning," and above 40.5°C.=104.9° F., in the "evening," high fever.

42° C.=107.6° F., and above indicates a "fatal termination, except in relapsing fever: hyperpyretic temperatures.

§ 16. A single observation of temperature (corroborated by other symptoms) may sometimes lead to a diagnosis or exclude another, or determine the severity or the innocuity of an attack.

§ 17. There are variations of temperature in the course of twenty-four hours in "health;" so in "disease," only greater. These variations, in febrile diseases, are subject to rules dependent on the kind, severity, and stage; upon them depends improvement or crises. If the daily temperature of a patient deviates from its pathological type, the cause of it must be looked for in circumstances, complications with diseases of another or no type, sudden re-

lapse, constipation, diarrhœa, sudden emptying of a distended bladder, spontaneous or therapeutic loss of blood, profuse perspirations, moving, fatigue, mental excitement, wakefulness, error of diet, thermal influences, or the operation of medicines and other therapeutic agencies.

§ 18. The daily fluctuations may be either simply ascending or descending. They almost always describe a "curve" composed of one or more "elevations" of temperature; daily *exacerbations*, and intercurrent "falls" of temperature; daily *remissions*. The number of degrees (extent of the "excursus") between the daily "maximum" and "minimum" is the daily "difference" or "range." When the "difference" is trifling the temperature is called "continuous;" when considerable, "remitting." The "mean" between the maximum and minimum is the "average" daily temperature; and its "height" shows the intensity of the fever. Typical forms of diseases have during their intensity a determinate average temperature, and seldom sink below or rise above their minima and maxima, unless shortly before death.

§ 19. "Continued thermometric observations" during a disease marked by high temperature afford the best materials for diagnosis and prognosis. They show us what is "conformable to law" or "normal" in the course of a disease, and often form a "correct example of a kind of disease." They mark distinctly the "stages" of a disease, even their mode of "transition;" they afford the best means of judging the severity of a case, its ameliorations, exacerbations, irregularities, relapses, restoration to health, imperfect recovery, and tendency to a fatal termination, besides controlling the entire treatment.

§ 20. In the course of febrile diseases we may distinguish the following stages or periods in the range of temperature.

Periods preceding the termination of a disease:—

The initial or "pyrogenetic" stage, longer or shorter, is considered closed by the development of a "localized process," or when the lowest daily average "characteristic" of the disease is reached. The "acme" or "fastigium," during which the fever maintains its characteristic daily temperature. The "amphibolic" stage (perturbation in some severe diseases), whose temperature is irregular.

Periods in case of recovery:

The "crisis, perturbatio critica," is the first stage of "decrement." The period of return to normal temperatures: stage of "deferrescence" or cooling. The "epicritical" and convalescent period, in which the temperature is normal or a little above or below.

Periods of the fatal termination:

The "pro-agonistic" period, preceding the death struggle, whose temperatures are varied, but more or less characteristic. The "agony," or death-struggle. The "act of dying," and the post-mortem changes of temperature. (These last stages may be so brief and contracted as to escape observation.)

Reviewing these periods separately:

§ 21. "The initial period" has often a characteristic type, but commonly escapes observation; it is varied by the morbid local processes which may accompany the fever. The patients previously ill and feverish, the type of the stage preceding the new attack is very vague. The intensity of the symptoms (temperature, etc.) in this period can found a diagnosis only when exceptionally severe.

§ 22. The next period, or "fastigium," affords "characteristic data" for a correct "diagnosis" in three ways: from the height of the temperature; from its successive alterations; from the duration of this stage. By the ele-

vation of temperature, its continuance at abnormal heights, and its deviations from the normal type, we learn the intensity and degree of danger of a disease. On the other hand, when the elevation of temperature is moderate, the duration of the maxima short, and the remissions early, we judge that the disease is of a mild type. Irregularities in the course of the temperature, even when they indicate an abatement of fever, are favorable only in special cases. A "rise of temperature towards the end of this stage" generally betokens some "complication."

§ 23. The "amphibolic" stage is generally present in severe and in fatal cases. It is more plainly recognized after a regular fastigium. Its complications are ushered in by noticeable elevations of temperature. As long as it lasts, days or weeks, we must be guarded in our prognosis. In it, a single very high or very low temperature is less significant than a steady one; a steady abnormal height threatens with relapse; moderately elevated, it renders convalescence probable.

§ 24. At the conclusion of either the fastigium or the amphibolic period there is commonly a "final rise of temperature," associated with other critical symptoms, "perturbatio critica," of which the character, very uncertain, can be judged by the further course.

§ 25. The stage of "decrement," or period of preparatory moderation, is wanting in many cases of recovery. The first failure of the temperature to reach its previous elevation, either at the evening exacerbation or in the morning remission, is the characteristic of this stage: it may fall in a single sudden descent as low as 36.5° C.= 97.7° F., once or oftener, with or without collapse.

§ 26. The period of "defervescence" or cooling may directly follow the fastigium, or be separated from it by an amphibolic period, a perturbatio critica, and a decre-

ment stage. It is a return to the norme, and has two different types, taking place in from twelve to thirty-six hours by a rapid "crisis;" or gradually, the process of occupying several days, by "lysis." The march of the defervescence may be by a continuous fall, which, however, when it lasts more than twelve hours, is less marked in the afternoon; or by a remittent fall, which is interrupted by evening exacerbations; collapse may supervene and protract the recovery.

§ 27. A rapid and regular defervescence is followed by a clearly defined "epicritical period," in which the temperature returns to normal through increased mobility and a sort of fickleness. Isolated and apparently causeless rises of 2°—3° C.=4°—6° F., relapses and secondary affections show themselves in this period, whose illimited duration merges in true convalescence.

§ 28. In "convalescence," or recovery, the disease having left no sequelæ, the temperature is much the same as in health; if it is not, or ceases to be so, sudden elevations indicate fresh complications; continuous elevations, a residuum of the original disease.

§ 29. In cases which terminate fatally, some signs of the approaching end appear in the fastigium or in the succeeding periods, among others a great irregularity of the temperature.

§ 30. During the "agony" or death-struggle, the temperature alters but little, remains where it was, sinks considerably, or rises enormously.

§ 31. At the "moment of death" the temperature may fall; but if it was rising "before," it may continue to rise "in" death and "after" death. In the former case the cooling is rapid, in the latter it is tedious, and corpses have been warmer than healthy men twelve hours after the cessation of life.

§ 32. In reviewing the course of "febrile" disease, we find that its duration and succession constitute five principal groups.

Fevers running a short course: febricula ephemera and terminal fever.

Fevers which exhibit slight daily differences of temperature during their acme, and detervesce rapidly by crisis: continuous fevers.

Acute fevers with a remittent course or character, whose milddle periods are marked by considerable daily differences between the evening exacerbations and morning remissions, and whose defervescence is also remitting and by lysis. (Extreme and deadly cases reserved).

The intermitting and relapsing types of fevers.

Chronic and protracted febrile affections, taking several weeks or months; type remittent, intermittent, continuous, or interrupted by considerable intervals free from fever.

§ 33. In febriculæ the temperature may rise, with or without rigors to 40°—40.5° C.=104°—104.9° F., seldom exceeding it; fall in a short unbroken line; last from a half-day to three. It is seen in traumatic fever, brief child-bed, the ephemera or weed of Ramsbotham, during the convalescence of slight catarrhs, etc.; the "paroxysm" of intermittent fever assumes this type. Another type of it rises little and slowly, and either returns to the normal temperature in one or two days, or gradually rises again to 40° C.=104° F., its culmination, then rapidly defervescing; it happens in the same diseases as the former, but in intermittent.

§ 34. Fevers which terminate a disease, terminal fevers, resemble the preceding, though widely different in their significance. In the period of apyretic diseases which precede death, or in the death-struggle itself, there is a rapid elevation of temperature at the point of culmination; or

after a slight fall, during the last moments, death ensues: this form is found at the conclusion of fatal neuroses, and in many cases of poisoning where the temperature may rise above that of life.

§ 35. Fevers with a "continued elevation" of temperature usually begin suddenly, with rigors and shivering. During the fastigium the average temperature fluctuates, according to severity, between 39°—40° C.=102.2° C.= 104° F., seldom more or less. The difference between the daily minima and maxima is ½°—1° C.=.9°—1.8° F., rarely more. Defervescence is tolerably rapid. This group is represented (but not always) in simple lobar pneumonia, in the eruptive fever of small-pox, in scarlatina (whose defervescence is less rapid), in cynanche tonsillaris, in meningitis of the convexity, in typhus (where the fever lasts longer), in the beginning of erysipelas, and frequently in intense fevers, which, previously remittent, pass to the continuous type with an increase of the temperature.

§ 36. In fevers with "a remittent" course, the initial period may be short or protracted. The average daily temperature varies from 38.5°—40.5° C.=101.3°—104.9° F., or more, because slight and severe diseases affect this type. It may last several weeks, defervescing by lysis. Typhoid fever is the best representative of this group, in which enter the catarrhal affections, influenza, catarrhal pneumonia, febrile rheumatic affections, measles, the commencement of basilar meningitis, acute tuberculosis, acute phthisis, and trichinosis.

§ 37. In "intermittent" and "relapsing" types, during the intervals of the paroxysms there are normal temperatures. For the "intermittent" the paroxysms are always short, seldom extending to a whole day; the temperature is higher than in any other disease of similar intensity,

with similar absence of danger; 41°—41.5° C.=105.8° —106.7° are common and passed by several tenths. The apyrexiæ are also short, from a few hours to three days; paroxysms and intermissions alternate with more or less regularity; that is the feature, hence the name of that fever.

In the "relapsing" the paroxysm is less limited, the temperature more variable, the intermissions longer, the "relapse" or characteristic repetition happens once only or twice, and more rarely a succession of times.

"Malarial fever" (ague) is the best example of the intermittent type, whilst "relapsing fever" is the best representative of the recurrent form. But many diseases approximate, with more or less regularity, one or the other of these types, especially pyæmia, erysipelas, true smallpox, many cases of true pneumonia, and not unfrequently acute tuberculosis, basilar meningitis, and acute phthisis.

§ 38. "Chronic" diseases, and those marked by "hectic," are of long duration, and their fever persists for years. Their course, seldom irregular, approaches some definite type, and may change it for another in time. Their type is usually remittent, with one or two daily exacerbations, some slight, some severe; so that the temperature reaches once or twice its maximum and falls as many times to the normal or below it. There may be a tertian or other rhythm, characterized by intervals of days left between the exacerbations. When complications come, or death approaches, the remitting type often changes into a continuous one.

§ 39. An "elevated temperature" (be its cause what it may) has by itself an influence on the functions of the body, on the nutrition of the tissues, and upon secretions. When it is only slightly raised we cannot appreciate its action on the system; but when it is, and remains consid-

erable, the most evident effect is a diminution of the weight of the body; besides, the pulse and respiration are accelerated, the brain exhibits functional disturbances, the secretions of the skin and the elimination of urea increase, and there is a tendency to local congestions, fatty degenerations, or even destruction of tissues. Yet these disorders do not elicit any proportion with that of the loss of caloric; and though the continuance of life is incompatible with certain elevations of temperature, we know not why.

§ 40. "Very sudden alterations of temperature" may influence the functions; rapid rises, especially when the warmth of the trunk considerably exceeds that of the extremities, are commonly associated with "rigors;" with rapid falls, succeeding previous height, then appear dyspnœa, delirium, signs of collapse, etc.

§ 41. Diseases which, instead of elevated temperatures, have abnormally low ones, never conform to rules as regards their pyrogenic course: inanition, sclerema, cancer, chronic intoxication, some mental diseases, etc.

Exceedingly low temperatures are, however, frequent (but intercurrent) in: the remissions of intermittent fever, in consequence of loss of blood or of powerful evacuations, in excessive defervesence, and sometimes in the death-struggle.

Abnormally low temperatures may disturb the functions, and lower yet render the continuance of life impossible.

CHAPTER III.

VALUE OF THERMOMETRY IN MEDICAL PRACTICE.

THERMOMETRY in disease is an "*Objective, Physical Method of Investigation*" which gives, earlier than the other methods, a more accurate and delicate measure of the changes in the organism. Its signs may be expressed graphically by traces, or numerically by figures, or by both.

The determination of the patient's temperature is valuable as the most essential element of study of a case; as its variations are symptoms of general disturbance, to search for the fixed laws which regulate the course of diseases (some of them already found), and for the deviations from these laws and their causes. As soon as thermometry attains to the discovery of one of these laws, it conquers a fresh territory for pathology, and reveals a "new world;" the domain of "law in disease."

But the alteration of temperature in disease is sometimes due to the morbid process, at other times to accidental or momentary influences. This creates confusions, to be overcome by a sound judgment exercised upon a greater number of observations.

Thermometry is a part of our method of diagnosis or observation of disease, indispensable where temperature varies, useful in doubtful cases, and auxiliary in almost every case. A medical attendant who undertakes to decide a case of fever or febrile disease without knowing the facts of thermometry, is like a blind man trying to find his way in an unknown locality. But thermometry is, be-

sides, called to discover the laws of the march of diseases, as well as the laws of their causes, and will become *Thermonomy.*

Many persons admit all this, but are incredulous as to its success outside of hospital practice and clinic teaching. But already thermometers are in the hands of a large number of practitioners; and the cost of the instrument is not excessive. As for the cost of time, we will see in "methods of observation" how it can be cheapened. Otherwise it often saves time, by rendering other modes of investigation superfluous. The public does not object to it, rather likes it, and we must give it its full value, by the precision of the method we employ to secure its most trustworthy results.

CHAPTER IV.

THE ART OF MEDICAL THERMOMETRY.

PHYSIOLOGICAL experiments on temperature may need thermo-electric apparatus like those used by Becquerel, Lombard, Gavarret, etc.; but medical thermometry requires only a good mercurial thermometer, and a systematic method of applying it. (Let the instrument be one of those whose equivalents have been estabished in a table at the end of this volume; and the method that of Wunderlich, which I beg leave to abridge in the terse language used in 1867 by Dr. E. C. Seguin, then house-physician to the New York Hospital):—

"The instrument *may* be centigrade or Fahrenheit, but it *must* be accurate. If self-registering, the nurse can use it at stated times, and the physician read it at his next visit. *Manual of the thermometer.*—The bulb is to be inserted in the axilla, previously dried, if moist from perspiration, just beneath the fold of the pectoralis major muscle, not too deeply, the forearm of that side carried across the chest, and the elbow secured by an assistant, or by the patient's other hand. It is left in *situ*, carefully isolated from all clothing, and in perfect contact with the skin, for eight or ten minutes, being looked at three or four times, the last two determining whether the column of mercury has ceased to rise; the degree (and fractions) is then read off and registered on a blank diagram.

"While waiting, the physician has time to count and record the pulse and respiration, and even to proceed with many other points of investigation. If the time be pre-

cious, the bulb may previously be heated, about to the expected heat, and then inserted, when three or five minutes will be enough for a correct estimate. With the exception of the anus, the axilla is found to be the most reliable locality for the purpose."

Besides the axilla, we apply the thermometer in the mouth, vagina, rectum, bladder, even in accidental or surgical cavities.

When taking observations we note carefully the number of the instrument, the hour, the day, the month and the disease; avoid taking it just after a copious stool, a vomiting, a hæmorrhage, a meal, or an abundance of heating or cooling drink, or during profuse perspiration. No use to note the temperature of the surrounding air, unless excessive; the same of barometric pressure.

Generally it is enough to *take the temperature* twice a day, from 7 to 9 A.M., time of the lowest temperature; and from 4 to 6 P.M., time of the highest; unless these daily remissions and exacerbations are displaced.

The observation is repeated oftener in important cases, in very acute diseases, in cases of doubtful diagnosis, and of deviations from the normal type; in fact, whenever anything special is noticed in the patient or occurs to affect him. Eventually these repeated observations are suitable from 3 to 4, 7 to 8 and 8 to 10 A.M., 12 to 1, 3 to 4, 6 to 7, and 10 to 11 P.M. In a rapid crisis, as in intermittent, hourly, half-hourly, or continuous observations can alone show the progress of the case. This demands an immense amount of labor. By whom shall it be done?

If one or two observations are needed daily, the physician must take them; and if he has no time he ought not to undertake the case. If more are needed he should know by whom and how they are taken, and be able to criticise the results. For the rôle of the surgeon is not

merely to take observations, but to superintend, control, and rightly interpret them: the mere reading of thermometer degrees helps diagnosis no more than dispensing does therapeusis.

As astronomic observations are often better recorded by honest, attentive assistants, than by astronomers; so, a nurse or relative can be made a useful assistant to the medical thermometrician. Whoever is selected must be trained for it, and his records controlled; but these records, sufficient guides in private practice, would not be admitted as elements of the formation of general principles or of laws of disease; they serve to shorten the labor in private practice.

In the wards of large hospitals, method alone can shorten this labor. To each patient the same instrument; all applied before the visit, nurses, etc., correcting their position, and noting the results, which the doctor soon controls himself; if he sees any difference, more time is given to repair the error. The results thus obtained should be continuously recorded on charts, or ruled maps, by a continuity of lines whose base and summit correspond to points, or sooner to figures, on the thermometric scale used. The pulse and respiration are there noted, too, by different graphic processes, as well as other symptoms. Each chart gives at a glance the history of a case; a collection of such charts exhibits the uniformity of the general course of a disease, promulgates its law, evidences the irregularities and the action of therapeutic agents.

CHAPTER V.

ON THE TEMPERATURE IN HEALTH.

THE "temperature of healthy human beings must be the basis of all our conclusions as to the temperatures met with in diseases." But the results of Physiological Thermometry are far less numerous and less trustworthy than those of Pathological Thermometry. Setting aside the admirable observations of Brechet, those thought to have been instituted upon healthy bodies—for instance, by Gierse upon himself—may have been made upon bodies really sick, or possibly sick, though thought healthy at the time of the experiments. Not so for the pathological observations, where no doubt can exist about the status of the patient. Besides, the pathologist has in hospitals abundant material for observation, and the physiologist does not find many well persons ready to be experimented upon, and animals cannot reliably be substituted to men on account of the larger range of their normal temperature. However, if it is yet almost impossible to draw a hard and fast line to indicate by the temperature the exact limits of health and disease, it is nevertheless true that the range of normal temperature in the axilla is from 97.25° F.=36.25° C. to 99.5° F.=37.5° C.; and that the mean normal temperature is 98.6° F.=37° C. Anything above or below must be looked at as at least suspicious.

Thus it appears that the normal temperature—though it is the result of continual production and loss of heat—remains the same; Lavoisier had made a similar remark in reference to the effects of food: "Quelle quantité d'aliments que l'on prenne, le même individu revient tous

les jours, après la revolution de 24 heures, au même poids à peu pres qu'il avait la veille, s'il est dans des conditions normales." As long as the body is healthy it maintains its normal temperature through the light oscillation just indicated; and in sickness "the sign" of convalescence is the substitution again of this healthy oscillation for the large fluctuations and deperditions of heat which threaten life. Thus thermo-physiology interests us as the foundation of medical thermometry.

The constancy (with oscillations) of the human normal temperature is maintained by two processes, the generation and the giving off of heat. The forces which are changed into heat in the body are the chemical affinities of its own substance, and of the material introduced into it from without. Of these substances the most important by far is the blood, which, on account of its capacity for taking up oxygen, is the main agent of heat-production; and, on account of its circulation, almost equalizes the temperature of all the parts of the body.

The "loss of heat occurs simultaneously with its production" by radiation (from the surface), by conduction, or transmission to other bodies, by evaporation of secretions in a gaseous form, and by its conversion in the produces of work.

We do not know so much about the "regulator of warmth," or natural process by which the production and the loss of heat are so well balanced; but we use rational processes to obtain that effect, as covering ourselves for a protection against the cooling of the surface, which is the chief seat of the loss of heat, as feeding upon certain substances, etc. Otherwise, when the organism is in a normal condition, the general temperature of the body maintains itself at the physiological point: 37° C.=98.6° F.

But the temperature of all the parts and of the viscera

is not uniform, and, locally considered, is not constant; the heat of the blood itself varies in certain parts of the body; but those are experimental phenomena, which medical thermometry has not yet turned to account.

The "variations in the temperature of healthy persons under varying conditions," are comprised in the limits of a few tenths of a degree, and move (under the axilla) between 36.2°—38° C.=97.16°—100.4° F. Dr. W. Ogle, "On the Diurnal Variations in Temperature of the Human Body" (*St. George's Hospital Reports*, 1866, ii. 221), gives a somewhat lower "minimum" and a somewhat higher "maximum": 36.1°—38.1° C.=96.98°—100.58° F.; the former on a winter morning, the latter in a Turkish bath. In delicate persons, and in women and children, the oscillation is somewhat greater.

"Influence of age on temperature." Before birth the infant's temperature is a trifle higher than that of the mother's uterus or vagina; a difference from which it may be inferred that the unborn infant has its own proper sources of heat, and its own means of cooling, by which it almost equalizes its tempearature with its mother's. Soon after birth, especially after the first ablution, infants lose from .7°—.8° C.=1.26°—1.44° F. In the next ten days the temperature rises and remains a little higher than in grown people. Besides this, the variations produced by ordinary cases are greater than in adults; even the act of crying will cause a rise of temperature; their morning, noon, and evening oscillations amounting to variations of .5°—2.6° C.=.9°—3.6° F. in infants apparently healthy. Through childhood, the same mobility and tendency to exaggeration may be recognized, but diminishes and disappears towards puberty. Thence to fifty or sixty years the temperature remains normal, to increase again, till at

eighty it presents the same elevation and characteristics as in childhood.

The "influence of sex on temperature" remains yet a debatable ground. John Davy considers that of the female somewhat lower; Wunderlich and Dr. Ogle slightly higher (½° F.). (*St. George's Hospital Reports*, vol. i.).

The "influence of race" invites study. Livingstone, "Travels in South Africa, p. 509," found the temperature of the natives 1.8° C.=2° F. less than his own; and Thomson that of the Fare Islanders somewhat higher than our norme, 37.2° C.=98.96° F. under the tongue.

No well-observed facts tend to establish a "difference of temperature between rich and poor, nor on account of difference of occupation."

"Idiosyncrasies" show their peculiarity in temperature as in anything physiological; but observations are too few to draw conclusions.

Temperature varies a little, "oscillates," even in healthy persons, according to the time of the day, by .5° C.=.9° F. Lichtenfels and Fröhlich state the time of the lowest from 10 P.M. to 1 A.M., and from 6 to 8 A.M.; the highest from 4 to 5 P.M. According to Damrosch the temperature rises from 7 to 10 A.M. about .5° C.=.9° F.; falls till 1 P.M. about .1°—.2° C.=.2°—.4° F. From thence till 5 P.M. it rises .2°—.3° C.=.4°—.6° F.; and then falls again till 7 P.M. by about .3°—.5° C.=.6°—.9° F. Occasionally the afternoon fall is absent, the 7 to 10 A.M. elevation and the 5 to 7 P.M. fall are the most constant.

Dr. Ogle's observations have been tabulated by Dr. W. B. Woodman. They were made in the St. George Hospital, by day in summer, by night in winter, and lasted many months. The average daily variation was ⅚° C.=1½° F. The minimum, a winter's morning, at 5.30 A.M. was 36.1° C.=97° F., and the maximum 38.25° C.=100.6° F., in

a Turkish bath. (Temperature taken under the tongue.) Means of monthly results:—

TIME OF THE DAY.	MALE.	FEMALE.
9—11 A.M. before breakfast.	97.73°	98°
11 A.M.—2 P.M.	98.2°	98.56°
3—5 P.M.; lunch at 3 P.M.	98.36°	98.75°
6.30 P.M.—7.30 P.M.; dinner at 7 P.M.	98.63°	98.6°
9 P.M.—10 P.M.	98°	98.45°
12 M.—12.30 P.M.	97.96°	98°
12.30 A.M.—1 A.M.; bed at 1 A.M.	97.9°	No observa-
3 A.M.—5 A.M.	97.5°	tion taken of
5.30 A.M.—6.30 A.M.	97.2°	females dur-
8 A.M.—9 A.M.	97.66°	ing the night.

The "influence of menstruation" upon temperature is insensible in health, and sensible in dysmenorrhœa and other less defined functional disturbances.

The "influence of pregnancy" is purely local; the gravid uterus warmer than the vagina (independent of the warmth of the fœtus) .15° C.=.4° F.; warmer than the axilla .3° C.=.5° F.

"Before the labor-pains," no rise of temperature. "During the pains," a rise of .2°—.25° C. which falls back between the pains. Elevation of temperature proportionate to intensity and quickness of pains. (Hecker.) Schröder found the excess of temperature of the uterus over that of the axilla, noticed in pregnancy, to increase in labor, and the lowest temperature in those delivered at 11 A.M. In the first twelve hours Winkel found a moderate rise, and in the second twelve a corresponding fall. The average minimum of the normal lying-in period is estimated by Grunewaldt at 37° C.=98.6° F., and the maximum often exceeds 38° C.=100° F. A normal temperature after birth is no guaranty against subsequent puerperal mischief (Schröder). The puerperal state being subject to great mobility of temperature belongs not here, but to pathology.

The "influence of rest, of muscular activity, and of work upon the temperature." This is a most complex problem. The contraction of muscles raises the temperature; and yet, Douville found that of a negro, basking in the sun, 40.2° C.=104.36° F. Working in the sun 39.75° C.=102.88° F. Hirn, while at rest, produced 155 heat-units, and whilst working at a treadmill, 251; and yet his temperature was not higher; because at rest the heat is not liberated, whilst at work, though produced in greater abundance, it passes off by more rapid breathing, quicker circulation, sweating, etc., besides the part converted through movement in labors in its factor activity; so that, though more heat-units are produced, more are evolved, and the final difference of temperature during rest and during labor is trifling. (Excesses reserved.)

"Mental exertion raises the temperature." According to John Davy less in northern climates, 36.6°—37° C.=98°—98.7° F.; in tropical climates much more, 36.7°—38° C.=98.1°—104° F. According to Lombard, of Boston, in mental repose the fluctuations are frequent but slight, .1° C.=.18° F.; in mental exertion the temperature rises .25°—.5° C.=$\frac{2}{20}$—$\frac{2}{10}$° F.

"In sleep," the production and loss of heat are balanced.

The thermal influences are modified by the nature of the agents, air, water, etc., which bring heat or cold in contact with us. They are also modified by their duration. Thus the immediate effect of cold is to abstract blood and to cool, as that of a higher temprature is to heat and prevent cooling. But every diminution or elevation of temperature which occurs through short thermal agencies is transient and followed by a reaction; so a high temperature of the body commonly follows a cold bath, and after a warm bath the body feels cooler. On the production and loss

of heat in baths see Fleury's Compendium, etc.; Liebermeister, Kerwig, Tolozan, and Brown-Séquard, *Journal de Physiologie*, etc.; Virchow's *Archives;* Bärensprung, Hope, Lehmann, Kirejeff, Hagspiel, etc.

The effects of "drinking cold water" (Lichtenfels and Fröhlich) was to lower the temperature; and that of immersing one hand in very cold water was to lower its temperature 8°—18° C.=18°—34° F. in a few minutes; did not alter the general temperature but lowered that of the "other hand," as soon as the immersed hand became painfully affected by the cold. Brown-Séquard and Tolozan (*Journal de Physiologie*, i. 497).

The "transition from a hot to a cold climate" (John Davy) lowered the temperature .88° C.=1.58° F., whilst the transition from France (temperate) to Mauritius (hot) gives to Brown-Séquard the following results on eight healthy persons, between seventeen and fifty-five. With the thermometer under the tongue, the atmospheric temperature at 8° C.= 56.4° F. he obtained a mean body temterature of 36.625° C.=97.9° F. Eight days later, with the temperature of the air at 25° C.=77° F., a mean body temperature of 37.428° C.=99.4° F., and nine days later, under the equator, with an atmospheric temperature of 29.5° C.=85.1° F., a mean body temperature of 37.9° C. =100.21° F. But six weeks later on the voyage, in 37.4° latitude, with the external air at 16° C.=60.8° F., the the mean body temperature had sunk to 37.25° C.= 99.04° F. (*Journal de Physiologie*, ii. 551).

The effects of "atmospheric pressure" on bodily temperature are too few to be authentic.

The "nutritious materials" introduced into the body, though chief means of warmth-production, hardly affect the temperature, because the excess of heat produced is disposed of. The breakfast raises the temperature more

than the lunch, and the evening dinner causes simply a delay in the fall which otherwise takes place at this time of the day. Generally the effect of a meal on temperature is slight, unless the individual is unwell or the food unhealthy.

The effects of "ardent spirits and other drinks" on the temperature of the healthy are thus resumed. Two pints or so (a maas) of beer lower the temperature of .5° C.=.9° F. in fifteen minutes. Wine and brandy lower the temperature too. In full doses brandy lowers the fever heat by fully two degrees, and gives the pulse fulness and frequency. But warm alcoholic drinks elevate the temperature; also coffee and tea; carbonic acid drinks lower it for a short time.

The effects of "loss of blood" vary; a little bleeding temporarily raises the temperature; a moderate bloodletting lowers it 1° C. for a few hours; or copious bleeding sinks it; but the lancet is now too seldom used to permit true experiments to be made.

To resume: the fluctuations of temperature in health are but slight; if they rise quickly they go down as quickly; a great increase of warmth is accompanied by a larger loss; a small production of heat is balanced by a slight deperdition. Herein is the mystery of organism: in health, calorification and decalorification compensate each other with a wonderful regularity; accidental disturbances are immediately brought back to the rule; disease will present the opposite phenomena.

CHAPTER VI.

CAUSES OF ALTERED TEMPERATURE.

THERMOMETRIC observations show how "narrow are the limits between health and disease," and how imperceptibly one passes into the other. Just so with the causes which determine the alterations of temperature.

There are some influences which are nearly certain to produce morbid changes of temperatures; but one and the same influence may induce very different, even opposite effects. The common basis of the operations of these influences does not depend so much on the increase or loss of heat, as on the "imperfection of its regulating power." This regulating power, or equilibrium factor, compensates the actions of the functions on which depends the temperature. Increased production of heat, or diminished loss of it, or increased giving off of warmth, or diminished warmth production, may act separately or together, in the entire body, or in some part of it, to destroy the balance of temperature, or to simply hinder the action of the regulating power. So, too, in sickness there is a *plus* and *minus* production and evolution of heat, "fresh sources of caloric" unknown to the healthy body, and besides there are new ways of "getting rid of heat." Among the new sources of heat-production are more "rapid destruction of the tissues" by chemical process, the "formation of abnormal products" of the metamorphosis of the tissues, and possibly the "development of some fermentative element," as a new source of heat, as in zymotic diseases. Of the modes of obstructing heat we

mention, copious losses of fluids and deposits of almost devitalized masses by exudation. For even when the normal equilibrium is disturbed in disease, a sort of abnormal one may be detected instead, ruling the apparent anarchy. This increased heat quickens the movements of the heart, which propels more blood to the surface, where it is cooled. The same cause increases the need of breathing, by which cool air is introduced in greater quantity, and the temperature lowered, etc.

The primitive causes of altered temperature in disease are the external influences, circumstances, or surroundings, the constitution of the individual, and the processes going on in the organism itself. We are yet powerless to measure the action of each of these causes on account of their intricacy; but we are already prepared to measure their sum total. The factors of abnormal heat escape mensuration, their quotient is within our reach by means of experiments, or by the artificial production of morbid phenomena. However, the results of these experiments are highly interesting, but not always to be trusted, because they are made on animals, whose range of normal temperature is larger than man's; the rabbits, for instance. But even were the experiments conducted on healthy men, we must not forget that the results may not be the same in pathological conditions, and indeed may differ from one disease to another.

It requires great attention and much thermometrical experience to separate the "effects of accidental circumstances" upon the temperature of the sick, from the "effects of the progress of the sickness itself," either in one of its periods, or towards its favorable or fatal termination.

The "depressors of temperature" abstract heat from the body, or increase the loss of heat, or hinder, or limitate

the access of warm blood to the parts under observation; and it is not easy to find which, or how many, and in what proportion these agents are at work.

The experiences on "elevated temperatures" are more numerous than on the "depressed." Any elevation above the norme originates either from an over-production, or from a diminished loss of warmth, or from both combined; but in elevated temperatures the respective shares of these conditions is not easier to determine than in diminished temperature.

Extreme degrees of "external cold" are the most certain means of abstracting warmth from the body; it may go so far as to render death inevitable. The greatest depression arrived at in rabbits before causing death was 9° C. = 48.2° F. Those cooled down to 18° or 20° C. = 64.4° or 68° F. could not regain their own temperature by being brought into a warmer medium, but were restored by artificial respiration.

There is no proof that "cold" brings on diseases; but "congelation" and its sequels do, as in Walter's rabbits. On the other hand, the application of cold on febrile temperatures has proved it one of the chief antipyretic and antiphlogistic remedies, especially in typhus and exanthematic diseases. Cold drinks and injections cool transiently; cold compresses and applications, ice-bag and sitz-baths, act more durably, but little beyond their locality; wet sheets, full baths, and douches cool more generally and permanently. The benefits accruing from cold applications in fever do not depend simply upon the subtraction of an overplus of heat; the question is more complicated, and much is to be learned yet.

External temperatures above blood-heat, when long continued, have a morbid influence, and cause that of the body to rise. This latter fact is taken advantage of to re-

store a body-temperature sunken below the normal by warm applications.

External irritants rather lower the temperature, mustard does not elevate it, pains depress it (Mantegazza).

Considerable hyperæmia (artificially produced) elevates the temperature. The temperature of the head rises in animals hung by their hind legs (Brown-Séquard). The ligature of an artery, throwing more blood to a collateral part, increases its temperature; conversely, narrowing or compressing a vessel lessens the temperature of the parts where it ramifies.

Therapeutics turn to advantage this action of heat and cold to increase or diminish the quantity of blood, as by local and general blood-letting, position, compression, ligatures, large cuppings (ventouses Junot), topical cold, heat, astringents, etc. The temperature is at first lowered by copious hæmorrhage from the lungs, stomach, intestines, uterus, and general blood-letting; but reaction soon follows, as remarked by Dr. Chs. Baunder, after hæmoptysis. Even the menstruation of the sick, often preceded by a rise, is followed by a fall of temperature; during it variations are more marked, and the disease is often judged by that crisis.

"Deprivation of food" lowers the temperature, a fact taken advantage of in therapeutics; but its effects, especially on the sick, are complex. (See Chossat, *Mem. de l'Académie des Sciences*, viii., p. 438; 1842. Schmidt, Lichtenfels, and Fröhlich).

The "introduction of nutritious substances," which does not affect the temperature of the healthy, elevates that of the sick or convalescent 2° C.=3.6° F. for a few days.

Constipation, retention of urine, and suppression of the catamenia raise the temperature; very relaxed motions

lower it, particularly when induced by purgatives. Vomiting depresses it more yet, even to the point of collapse.

The "lowering of the temperature by alcohol" is with the sick the same as with the healthy, only more marked. Poisonous doses of it depress considerably; cases have recovered, in the London Hospital, after a fall to 32.2° C.=90° F. The ingestion of alcohol diminishes or retards the tissue-changes. Though usually followed by a reaction, the effect of alcohol in fever is to lower the temperature. Habitual "soakers" have, as a rule, a lower temperature than the average patients, and fall more easily into collapse, though a high temperature is often met with at the termination of fatal cases of delirium tremens. Other more or less poisonous substances depress the temperature—ether, chloroform, chloral-hydrate, opium, hydrocyanic acid, hyosciamus, digitalis, belladonna, tobacco, euphorbium, camphor, acetic, oxalic, sulphuric, nitric, and hydrochloric acids; the mineral acids altogether, and saline purgatives also.

The "raising of the temperature" is one of the effects of the toxic incorporation (in health or disease) of many substances, as coffee, musk, curare; it follows, too, the subcutaneous introduction of certain animal substances, like pus, or the blood of other animals suffering from fever of any kind (Bilroth and Hutschmidt). This depends not on the fibrin, since beating and filtering do not change the result; nor on the pus-corpuscles, but upon the serum of the fluids, which keep this "property" even when boiled and filtered. The maximum of temperature thus incited is obtained in two or three hours, the return to the normal in three to six (Freze), and E. Bergmann, who made other observations of the same kind, says that subcutaneous injections of large quantities of water, or smaller of irritative

substances, produce very similar alterations of temperature to those noted by Freze.

The specific morbid processes, like septicæmia and pyæmia, resemble the pyrogenic action of animal substances introduced into the system; but most of them are imperfectly understood. Andral states that when the blood contains more than $\frac{4}{1000}$ of fibrin the temperature rises in a corresponding ratio; thus pneumonia, being noted for its great increase of fibrin, presents the highest temperature of all the phlegmasiæ, from 39° C.=102.2° F. to 41.2° C.=106.16° F. But in acute pleurisy there is less fibrin, and the maximum temperature averages 39.5° C. =103.1° F. Though he does not consider an excess of fibrin as the only cause of abnormal rise of temperature; for in pyrexia (where there is no such excess), the temperature is as high or higher than in phlegmasiæ. Thus 42.4° C.=108.32° F. has been reached in typhoid, 42° C.=107.6° F. in the onset of small-pox, in the hot stage of ague, in glanders, etc.; indeed, the highest degrees appear in diseases where there is the least fibrin in the blood. The number of red globules does not much affect it. The escape of albumen in the urine may lower it, but facts are wanted. The amount of urea in urine is a good test of fever, 10 to 15 per 1,000 are considered normal by Andral, who found in 53 patients whose temperature was normal, $\frac{12}{1000}$ average of urea; in 45, with non-febrile diseases, from 4 to 12 per 1,000; but in 23 cases of intermittent fever the urea ranged 13 to 32 per 1,000 (W. B. Woodman).

The "influence of the nervous system upon temperature" has been the object of extensive researches, the most important to be summed up here.

In "Experimental Researches" (page 9, Phila., 1853), Brown-Séquard expressed the opinion that the increased

warmth following the section of the cervical sympathetic ought to be attributed only to a paralytic dilatation of the cephalic blood-vessels, and to the consequent larger amount of blood flowing in the parts. On the increase of animal heat after injuries of the nervous system his conclusions are: An injury to the nervous system may cause either an increased or a diminished temperature in the parts which are paralyzed by it. It appears that the respective shares of the sympathetic and cerebro-spinal nervous system, in producing these, cannot well be determined. The degree of temperature of paralyzed parts depends on the quantity of blood which they contain, and this quantity varies with the condition of the arteries and capillaries of the parts. It is a matter of fact, hitherto unexplained, that the arteries and capillaries of paralyzed parts may be either dilated, normal, or contracted.

Budgé (*Comptes Rendus*, xxxvi. 377) has shown that this elevation of temperature is not produced by the division of the sympathetic, but that injuries of the parts of the spinal marrow which lay between the seventh cervical and the first and second dorsal have the same effect on the temperature of the head. Waller (in p. 378) attributes the rise simply to the paralysis of the circular fibres of the smaller arteries, and to the hyperæmia thus induced, caused by the section of nerve. De Ruyter, "De Actione, Art. Belladonnæ," explains this phenomena by a larger accession of blood in the parts.

Schiff observed that difference of the temperature of the two sides of the head (taken at the ear) may amount to 12°—16° C.; that this difference then, was proportionate to the difference in the quantity of blood in the parts; and that when (as exceptionally occurs) the section of the cervical sympathetic has no effect on the vessels of the ear, there is also no elevation of temperature; seeking to

prove that the increased fulness of the vessels depends upon paralysis of the blood-vessels; and that the larger the quantity of blood, the higher is the temperature. He holds that, in complete spinal paralysis of a part, the temperature of this part must be elevated; but that in incomplete (paralysis of motion only) the temperature must be diminished; conclusion which has since been partially confirmed by pathological facts.

Later, Schiff excited fever by injections of pus into the pleura, or into the vascular system after dividing the left cervical sympathetic, or resecting the nerves of one extremity. As soon as the fever set in, the parts unaffected by the section rose in temperature, whilst those affected with vaso-motor paralysis (though previously warmer) rose slowly or not at all; and finally the former remained warmer than the latter: hence he concluded that the hyperæmia induced by nerve-section and by fever are of different nature, the latter being the more active of the two.

Kusmaul and Tenner strengthened the doctrine which attributes the thermal phenomena to the amount of blood, by constantly reducing the increased warmth of the ear on which the sympathetic was divided, below that of the other ear, and even lower than its own temperature, before the section, as soon as (in addition to ligaturing or compressing the carotid on the same side) they also ligatured the two subclavians at their origin, to prevent collateral circulation.

Brown-Séquard then discovered that complete division of one lateral half of the spinal cord in the dorsal region was followed by a rise of temperature in the hinder extremity of the corresponding side, and by a fall of temperature in the opposite limb. Schiff confirmed this, but attributed the fall to an accidental injury made to the other half of the cord.

Tscherschichin, after complete section of the cord in a variety of parts, always observed a suppression of the active operations of the vessels and a sinking of the general temperature, in addition to the loss of voluntary movements (1866). But when he divided the medulla oblongata in a rabbit, near to its junction with the pons, the temperature began to rise, the pulse and respiration greatly quickened. After half an hour the temperature was 39.4° —40.1° C.=102.92—104.18° F.; after an hour, 41.2° C.= 106.16° F.; after one hour and a half, 42.2° C.=107.96° F.; after two hours, 42-6° C.=108.68 F. More rapid breathing and convulsions set in; death half an hour later.

The pathological conditions analogous to the results of the former experiments are—the local alteration of temperature in neuralgias; observations of temperature in paralyzed parts; observations of variation of temperature in those forms of disease which are considered as vaso-motor neuroses; the effect of mental exertion or excitement in elevating the temperature, and of sleep in lowering it in fever; the great elevation of temperature in acute inflammation of the brain; the more enormous elevation in injuries destructive of the spinal cord; the very disproportionate rise of temperature at the end of tetanus and other fatal neuroses.

These facts favor the theory that a large share in the regulation of heat belongs, at least in complex cases, to the nervous system. The influence of certain nerve-tracks on the activity of the heart and on the circulation is indubitable; many of the pathological phenomena of warmth depend on the action of the vaso-motor nerves; the most remarkable alterations of temperature occur with profound disturbances of the nervous system, without corresponding anomalies of the circulation; and the integrity of certain parts of the nervous central apparatus is

more necessary for the regulation of animal heat, than that of any other part of the body.

"Muscular exertions" generally cause a notable rise of temperature in cases where there is any previously existing morbid condition, however slight. On this account "we are quite justified in feeling anxiety about the health of any one whose temperature exceeds the normal after only moderate exercise, however cheerful and apparently well he may seem in other respects."

During "convalescence" temperature rises one or more degrees Cent. The first sitting up does the same; and the removal of a sick person so much more, that the first observation of temperature after the admission of a patient to a hospital, or after a journey, is not trustworthy.

This large enumeration of the influences which affect the temperature is not exhaustive. Many have been omitted as due to complications, others to phenomena known to exist, but not yet scientifically demonstrated, such as a process of fermentation of the blood, or chemical changes affecting the production of warmth, etc. The individual circumstances and surroundings, idiosyncrasies, etc., have also been left out.

A word about age, to close:—

In children the temperature in disease is extremely mobile and sensitive, its extremes greater. Women resemble children in this respect; their temperature springs up or down without apparent causes, especially if they are hysterical; this mobility is found also among nervous men; those more advanced in years present more steady temperature with less susceptibility to impressions; old people present a temperature .5° C. = .9° F. less than younger persons.

Finally, the repetition of certain influences augments the sensibility of the temperature in some persons or cases, and weakens or blunts it in others.

CHAPTER VII.

ON LOCAL ALTERATIONS OF TEMPERATURE IN DISEASES.

The sickly variations of temperature are general or local. This antithesis is not absolute, but relative; since any considerable local alteration of temperature can hardly fail to be propagated to the rest of the body in certain proportion, through the circulation. On the other hand, a general rise of temperature is never so uniform as not to leave some parts cooler than others. But the two alterations are, nevertheless, distinct, and demand a separate attention.

In health, different parts have different temperatures; in disease, these differences are more marked.

Local elevations of temperature have been observed in inflammations, first by John Hunter, since by Brechet. John Simon found (Holmes' "System of Surgery, art. Inflammation," vol. i., p. 43), and O. Weber verified, that the arterial blood supplied to an inflamed limb is less warm than the focus of the inflammation itself; that the venous blood returning from an inflamed limb, though less warm than the focus of inflammation, is warmer than the arterial blood supplied to the limb. And that the venous blood returning from an inflamed limb is warmer than the corresponding current on the opposite side of the body.

There is no trustworthy observation of a rise of temperature through simple hyperæmia (Billroth); there is an appearance of rise in exanthemata (Bärensprung); in neuralgia and local cramps the skin of the affected parts is somewhat hotter. As regards paralysis, Folet (in *Gazette*

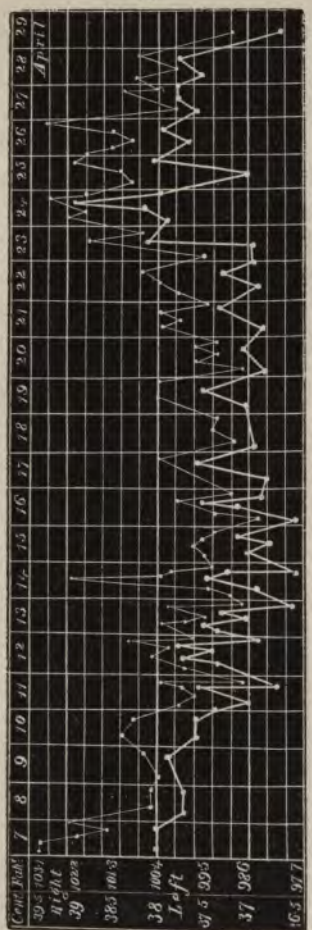
Hebdom., 1867) gives the following conclusions from his long observations on hemiplegic patients :—

In the immense majority of cases, the commencement of hemiplegia is accompanied with an increased temperature on the affected side ; both sides are very seldom alike, and a diminished temperature on the diseased side is hardly ever noticed. The rise of temperature varies between .3° and .9° C.=.54—1.62° F. ; but seldom exceeds 1° C.= 1.8° F. The presence or absence of contractures has no influence on the thermometric results. The thermometric difference may be greatly augmented by various causes. But the original cause of hemiplegia has no effect upon the result. Recovery from the paralysis tends to equalize the temperature again : if the paralysis continue, the height of the temperature varies greatly, and in one case may return to the normal in a few months ; in others it may continue unequal for years together. Undoubtedly paralytic atrophy necessitates depression of temperature. In an old hemiplegia, when the affected side exhibits a high temperature, and the other side becomes paralyzed at a later date, either the two sides become equalized in temperature, or the side last paralyzed now becomes considerably hotter. The general temperature of hemiplegic patients is not usually above the normal, but exhibits an average height of 37° C.=98.6 F., except in the last hours of life, when it generally rises.

The results of Lepine's observations on hemiplegia show smaller fluctuations of temperature than in health, either upward or downward, under external thermal influences. In recent hemiplegia, the paralyzed limb exposed to cold loses more heat at first, less when the cold increases. In very old cases the paralyzed limb appears colder than the other, but remains relatively warmer. When exposed to heat again, it becomes less warm than

the second one, exhibiting less sensibility to both heat and cold.

Fig. 1.



A girl, aged 18, presented during almost a year the following symptoms :—An increased temperature all over one-

half of the body, connected apparently with spinal hysteria; higher temperature on the skin than in the vagina by .2° —.5° C.; and in the right axilla and groin more than in the left by 1.5° C.=2.7° F. There were at times right-sided hyperæmias, urticoid eruptions, local sweatings, and various troubles in the internal organs.

Fig. 1 gives the traces of the movements of her temperature on both sides during three weeks. Here was evidently an affection of the vaso-motor nervous system, which acted on one side more than the other.

But local anomalies of temperature are too numerous to mention, and we come to the "alterations of general temperature," which are the most important phenomena in pathological thermometry.

CHAPTER VIII.

TYPICAL FORMS OF DISEASES ASSOCIATED WITH ALTERATIONS OF TEMPERATURE.

In many diseased conditions the anomalies of temperature consist solely in its "increased mobility." This extreme mobility is met with, not only in definite diseases, but also where we can recognize but slight disturbance of the general health—chronic, limited, or transitory.

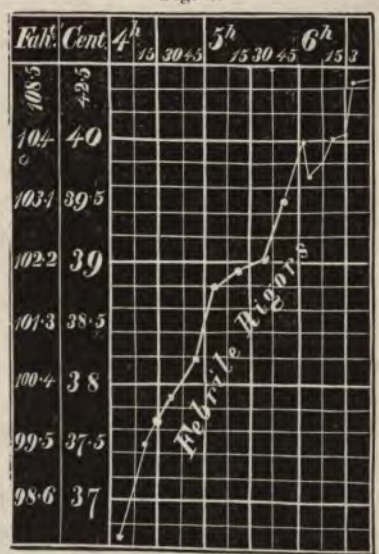
We often meet with cases in which the temperature of a patient "remains a little above the normal," either persistently or in the form of nightly rise. In addition, there may be the increased mobility above mentioned, besides isolated and apparently causeless elevations of temperature. This is seen in obscure disturbances, convalescence (especially in articular rheumatism), and in the decline of diseases.

We meet more rarely with the "descending type" of temperature, in which the thermometer remains below the normal, or shows only rare intercurrent elevations. This form is seen in inanition, marasmus, cancer, diabetes, extreme anæmia, rarely in phthisis; in mental depression, lypemania, chronic and declining diseases.

The affections whose "alterations of temperature assume a definite and characteristic type" come next in order. Their types are: the rigors, chills (*fieberfrost*), cold stage of fever, fever-heats, hot stage of fever, pyrexia, collapse. These alterations of temperature are not the sole characteristics of these pathological processes, but simply those which we will study here.

During the rigor the temperature of the body is about 40° C.=104° F., even more; but the extremities are cold, bluish, or pale, and affected by automatic movements, accompanied with thirst, watery urine, etc. The rigor occurs at the beginning of the fever, or is an incident of it; but generally the excess of temperature precedes the rigor (see Fig. 2), at first in the body, and subsequently reaches the extremities. This is the typical cold stage, from which there are deviations and attenuations, and which finds its analogue in the shivering of nervous people, in some forms of intoxication, etc.

Fig. 2.



Rigors occur, also, with a falling temperature, or in the midst of an elevated one, or when it rises 2° to 3° C. rapidly from a very low point, say 35° C.=95° F. This and the absence of rigor in many instances of elevated or falling

temperature, shows that we must look for the cause of the *fieberfrost* in the suddenness of the difference of temperature between the periphery and the viscera, or the extremities and the trunk.

Pyrexia (hot stage, or fever heat) may follow rigor, or may start from a normal point, as in the ephemeral fevers of convalescents. Discomfort, thirst, and other subjective feelings, may be absent; but oftener they are present, and with them are found alterations of the pulse, of the urinary secretions, of the breathing, etc. Indeed, there is no necessary parallelism between the height of the temperature and the kind and degree of the other phenomena; and though this may lead to the theoretical belief that temperature is a deceptive guide, practically the reverse is empirically true.

During pyrexia some parts may be warmer than others; and by this we mean not only the body, but the head, or ears, or palms of the hands, etc.; the height of temperature may vary greatly, or become excessive. Perspiration abates this, sometimes below the normal point. A tremendous increase of heat often precedes death.

Collapse occurs by itself in the middle of pyrexia, in the sequel of fevers, rarely during rigors, which it somewhat resembles. Not a disease itself, unexplainable by pathological anatomy, it is the shortest and last act of the drama of life.

When slight, it does not modify the appearance of the patient; growing worse, it substitutes for free circulation and breathing a cold perspiration, and annihilates the signs of vitality; it occurs after loss of blood, perforation of serous membranes, or chronic diseases; is most severe and protracted in Asiatic cholera. In chronic diseases collapse may be transient, prolonged, or repeated.

Cases of collapse with a falling temperature in the trunk

are those most commonly met with in febrile diseases, and these require to be watched with the most pains-taking care. The previously more or less high temperature sinks to the normal, and often considerably below 35°—37° C.= 95—98.6° F. The fall is usually sudden, in a few hours or less. The descent may amount in half a day to 6°—8° C.=10.8—14.4° F., or more. Cases of collapse may last a few hours only, or several days, through rises and falls, and the patient dies in it.

The collapse in which the temperature of the trunk falls occurs during the stage of defervescence, mostly in pneumonia, also in acute exanthems, etc.; then the condition may look critical and yet be quite devoid of danger; during the remission of fevers, oftener the typhoid; in the transition stage from intermittent fever to an apyretic condition, especially in pernicious malarial fevers and in pyæmia; during rigors in pernicious malarial fevers, in other severe diseases, and in very delicate and susceptible individuals; in incidental perturbations caused by blood-letting, vomiting copious evacuations, extreme nausea, pains, exudations, perforation of pleura or peritoneum, and the formation of coagula in the heart; in many kinds of intoxication and in the cold stage of cholera; in the pre-agonistic period, and in the death-agony.

Cases of collapse with elevated temperature of the trunk are scarcely to be met with except in cases of severe fevers; and it appears as if a very elevated temperature directly predisposes to such collapse.

Comparison between these three forms of constitutional disturbance—fever-frost, fever heat, and collapse—shows that the temperature may be above the normal in all; always high in pyrexia, highest in febrile rigors, generally above normal in collapse. No distinction, however, can be drawn between these forms from the mere height of the

temperature. Normal and subnormal temperature often occur in collapse, but exceptionally in case of incomplete rigors. The extremities are always cold in collapse, generally in rigors. A rapid rise at the trunk, with cold extremities, is associated with rigors; a rapid fall at the trunk accompanies collapse. The recurrence of warmth in a particular part, when that of the trunk remains high, is peculiar to collapse.

We are met by insuperable difficulties when we try to explain theoretically the true meaning of all these varieties of temperature. Previous attempts at explanation had in view the theory of fevers, and ignored the condition of collapse itself.

But even as regards attempts to explain fever, temperature alone does not do it, complex organic phenomena cannot be solved by one simple formula. Those of Virchow, in his "Hand-book of Pathology," etc., Zimmerman, Cl. Bernard, Schiff, Traube, Behse, Auerbach, Wachsmuth, Billroth, O. Weber, Senator, etc., though one-sided, throw light on the subject, but fail to explain, "On what does the abnormal temperature depend?" Fever remains, after all has been said, a complex assemblage of varied phenomena, of which one of the most important is the alteration of temperature, though all the others cannot be explained by it.

Of all the symptoms, the "course" of the temperature must be studied first. Its principal alterations are: A general rise of temperature (all over the body), an increase of temperature in the greater part of the body, a general diminution of temperature all over the body.

"An increase of temperature all over the body" (an ordinary phenomenon at the beginning of a fever) is determined by a deficient abstraction of warmth, itself attributable to a variety of causes; from a pathological

focus of warmth-production, the ustion is communicated to the entire body through the circulation; an abnormal activity in the modes of production of heat may cause a general elevation of temperature, if the means of giving it off are not adequate. A general elevation of temperature may also occur through pathological chemical processes, as an increased combustion of hydrogen in fevers, or a sudden diffused organic decomposition producing caloric, or an over-production of heat by extreme muscular contractions towards a fatal termination, or new combinations of elements putrescent or fermentable, not demonstrated yet, but probable, such as could be produced by the transfusion of fever-blood, or of the ferments advocated by the zymotic theory. Alterations in the degree of activity of the vaso-motor nerves can, if extensive and persistent, influence the temperature in several ways. Elevation of temperature may occur in consequence of a morbidly increased action of the spinal centres. At times the above causes combine or succeed each other so as to render difficult a judgment upon their respective influence.

And lastly, the "same temperature" may indicate a very different quantity of over-production of heat, according as the amount given off is diminished, normal, or increased. Here are present opposite constitutional disturbances, since, in long-continued high temperatures, urea may be in excess, and the body lose a great deal of weight; or the latter may waste but little, and furnish few products of tissue-change.

"An elevated temperature which extends over the greater part of the body, whilst that of other parts is lowered," may arise from an unequal distribution of the heat produced in the body, or from an unequal cooling through the surfaces, in contrast to the continual increase

of internal production of warmth; oftener from unequal fulness of the blood-vessels. But it may come from a variety of causes: a patient in rigor and another in collapse feel very differently, notwithstanding the fact that the contrast between the temperature of the trunk and that of the extremities is identical in both.

"A lowering of the temperature all over the body" can only be induced by diminished warmth-production, increased loss of heat, or both these conditions together. It may occur after previous normal, low, or high temperature. In the latter case the fall may not be so low as 98.6° F., and yet have the same import as if it had fallen under the norme. It is difficult to assign the respective share of diminished production or of increased loss of warmth, in a fall of temperature; it is easier to detect its causes either by its mode of progression, or from the action upon it of some remedies.

The remaining phenomena of rigor, pyrexia, and collapse may be attributed to the altered temperature itself, but react upon the temperature in their turn; for instance, an increased temperature affects the movements of the heart and respiratory organs, but an altered rhythm and force of the heart, and changes in the respiration, affect the temperature: this shows the interdependence of organic operations, whose combinations would defy human reason, was it not that disease itself has its laws, which we can discover by laborious observation, though we cannot yet codify them.

Thus "a rigor" is a complex commencement of a series of phenomena, rarely a process complete in itself. It is most sure to come when the temperature of the trunk rises so rapidly that the extremities are left in the cold behind. But this condition is not inseparable from a rigor, nor a rigor from it; since rigor may be absent, in febrient

persons not very impressible, or after the use of quinine, though it will not prevent the hot stage, etc. In very sensitive people a slight contrast of temperature will bring it, even in health.

"Pyrexia" is an effort of the warmth-producing and warmth-exhaling powers to restore their equilibrium. It is preceded by rigor when strong, and without rigor when gradually brought about.

"Collapse" may occur as a primary phenomenon, or an episode in a short pyrexia, or at the close of a fatal disease. The primary depends on some nervous trouble, and is accompanied with great loss of heat and profuse perspiration. The episodic may be due to special influences, or to circumstances of the disease, by which are caused great and uncompensated loss of heat, particularly at the periphery. The pro-lethal may be due to similar causes besides an absolute deficiency in the production of heat. Collapse, during the transition from disease to health, occurs when from the height of an elevated temperature a rapid fall sets in. The favorable issue of this crisis at the end of a sickness is due to the restoration of the power of producing a normal instead of a morbid warmth.

CHAPTER IX.

DIAGNOSTIC VALUE OF SINGLE ISOLATED THERMOMETRIC OBSERVATIONS.

A SINGLE observation of temperature is always an imperfect and unsatisfactory standard; it may have been taken at an important or insignificant or deceitful moment. However, a detached observation is worth taking, because it may decide if a person is healthy or ill, or feigning a disease; it gives an idea of the severity and urgency of a sudden disorder supervening on another; it assists in diagnosing one kind of disease and excluding others; corroborated by other symptoms and circumstances, it may be the basis of diagnosis and prognosis; the divergence of a single temperature from the general course may be valuable; each observation of a series must be considered in some respects as a single one; the conclusions derived from a single observation are valuable in proportion to its thoroughness; greater accuracy in recording the temperature is needed to render valuable a single observation than a series, where a difference of .2° C.=.36° F. is of no consequence, or at least will not affect the practical value of the conclusions.

With few exceptions the range of human temperatures (healthy and sickly) is 8° C.=15° F. Its minimum, more difficult to ascertain than the upper degrees beginning with 35° C.=95° F., rarely descends to 33° C.=9.14° F. Surface temperature in cholera has indeed been observed as low as 26° C.=78.8° F.; but how much higher in the vagina or rectum? There are no recorded maximum

temperatures in the living subject higher than 44.75° C.=112.55° F., observed by myself in a case of tetanus. Just after death the temperature may rise higher, as it did in this case, where fifty-five minutes after death it amounted to 45.375° C.=113.675° F. But even temperatures of 42.5°—43.5° C.=108.5°—110.3° are exceptional. The high temperatures met in even fatal diseases do not commonly exceed 41.5° C.=106.7° F. Narrow as seems to be this range, its included degrees are full of meaning for those who know how to draw conclusions from them.

Axillary temperature less than 38° C.=30.4° R.=100.4° F., proves actual absence of fever (apyretic). The nearer to that point, the closer and oftener we must look; since, thence to fever, there is no line of demarcation, circumstances will often decide; as when the highest temperature arises in the morning before the stimulation of food or exertion, etc., fever is more probable.

All temperatures which exceed 38° C.=100.4° F. are "suspicious," probably febrile; 38.4° C.=101.1° F. mildly febrile; anything above, decidedly febrile. Then to determine whether the fever is moderate, considerable, or extreme, we must consider the time of the day at which the temperature was taken; the same temperatures being important or insignificant as they occur at the usual time of rise and fall, or otherwise.

Some temperatures exceed considerably those common in high fevers. They occur in circumstances where there is no corresponding development of fever. Either the other usual symptoms of fever are wanting, or they are not developed in a corresponding degree to the extraordinary rise of the temperature; hence the latter is called *hyper-pyretic.*

When the temperature exceeds 41° C.=105.8° F., we may suspect the case not to be one of simple fever; if it

rises higher, say above 41.5° C.=106.7° F., this suspicion becomes almost a certainty. The circumstances producing such high temperatures are varied. They occur in some specific forms, doubtless infectious, as malarious or intermittent, where temperature may rise more than once to 41° C.=105.8° F., or in relapsing fever above 42° C.= 107.6° F., without being fatal. In diseases of a favorable type, terminating in recovery, 41° C.=105.8° F. is more exceptional, of shorter duration, and sometimes precedes the crisis. There are diseases whose chief character is "malignancy." Some are "specific and infectious," others are suspected of it, in which high temperatures are met with. The question remains an open one whether the excess of temperature causes the malignancy or the reverse? Typhus, scarlatina, measles, pyæmia, parenchymatous hepatitis, malignant pneumonia, puerperal fever, meningitis of the convexity, and fatal rheumatic affections, present these sudden elevations of temperature; they last but a few days, but at 41.5° C.=106.7° F. the prospect of recovery is small; at 41.75° C.=107.15° F. death is almost certain.

During the last hours of life temperature sometimes rises enormously, often by a sudden spring to 41°—42.50°—44° C.=105.8°—108.5°—111.2° F. It is so in tetanus, epilepsy, and hysteria, near a fatal termination, inflammations of the brain and medulla spinalis, injuries to the upper part of the medulla, and in other cases where there had been no previous evidence of the nervous centres being implicated.

"Collapse-temperatures" are not identical with collapse; for they may happen without it, and with an elevated temperature of the trunk.

The "absolute height" of a given temperature, without its antecedents, can mislead in diagnosis and prognosis. Thus isolated the highest only portends danger, with this

limitation: higher temperatures are borne in typhus and typhoid fever than in pneumonia, in scarlet fever than in measles, in relapsing fever than in any other; there, 42° C. =107.6 F. being almost free from peril. The highest temperature in a case of recovery, 43.3° C.=109.94° F., was noted by Mader of Vienna, in a soldier suffering from irregular intermittent, repeated hæmorrhages, deafness, etc.; transfusion saved him; one case of sun-stroke at 42.8° C.= 109.4° F., and two of relapsing fever at 42.2° C.=107.96° F. recovered; three others exceeding 42.125 C.=107.825° F., occurring in the rigor of typhoid fever, ended fatally.

It is less easy to assign the limits of the temperature downward. The lowest among my cases of recovery was 33.5° C.=26.8° R.=92.3° F., pulse 62 (collapse of defervescence in enteric fever). In all less extreme degrees of temperature attention must be paid to idiosyncrasy.

In "children" the significance of temperature is in the main identified with that of adults; but their changes are more sudden and extensive; consisting in more sudden "plunges," earlier rises, and a somewhat higher temperature throughout. They are affected more and quicker by incidental influences; so that a high febrile temperature in a child, unless from malarious origin, has not the same import as in adults, where it would almost warrant a fatal prognosis; but it must be watched more closely, since it ends sooner, either way, in twelve or twenty-four hours. Ephemeral fevers are very characteristic of childhood; therefore we must not draw conclusions from the first or a single observation. We find their temperatures high in cases where those of adults are almost normal, particularly in convalescence, after muscular exertions, etc.

On the other hand, "old people," everything but age being equal, show in sickness a fall from a half to a whole degree, C.=.9—1.80° F. under the average, even below the

minimum of younger people; this fall commences sometimes rather early, since between forty and fifty the majority of men begin to exhibit this senile character: so constant is it that in a given disease, it will aid in determining the age of a patient. On the other hand, this physiological age of the temperature may lead to mistakes, for which see Charcot "De l'État Fébrile chez les Vieillards" (Nos. 69 and 71 of the *Gazette des Hôpitaux* 1866), and Bergeron, "Recherches sur la Pneumonie des Vieillards."

Many women, and delicate, effeminate men, exhibit a similar course of temperature to that of children; let us judge them by the same standard.

The "time of the day at which temperature is taken" has a diagnostic value. In the period of digestion it rises more in the sick than in healthy people; this and other incidental influences must be taken into account, particularly in a solitary observation. Therefore, before drawing conclusions from a single thermometric reading we must notice the other symptoms, and consider whether they agree or contrast with the temperature; and see how many-sided are those symptoms and their relations. The temperature itself may be altered by an accessory disease of some organ, which itself modifies the other symptoms; or the altered temperature, and other symptoms, may result from a definite primary cause, infection, intoxication, or external morbific agencies, etc.

High and protracted alterations of temperature produce functional disturbances and even alterations of tissues; they lay the foundation of diseases of the circulatory, respiratory, secreting, and nutritive systems, and of the nervous functions generally. However, there is no "exact parallelism" between the high or low temperature and the gravity of the accompanying special symptoms; and we

know empirically that, in particular, the gravest nervous symptoms do not coincide with the actual height, but oftener with the most rapid changes of the temperature.

If the temperature "harmonizes" with the other symptoms and the diagnosis deduced from them, it is an additional, and often decisive confirmation of the latter. But if the temperature contrasts with the other symptoms, we must rely more on temperature; but if it is less marked than they, we ought to repeat our thermometric observation, and make inquiries as to the type or stage of the disease which may cause the discrepancy. Then the discrepancy itself will be explained, either by the slight type of the disease, or by its advanced stage, or by some marked development, or by the initiation of collapse, etc.

If the heat is normal or slightly abnormal, and the "subjective symptoms" strongly expressed, we have reason to suspect simulation or exaggeration, and to hunt it down; but if the expression of subjective feelings is very indifferent, and the temperature high, we have reason to suspect and to search for a severe and extensive disease, as typhus, etc. Otherwise, at the very moment of a favorable crisis, miserable feelings may concur with normal or subnormal temperatures: a form of defervescence verging in collapse, not to be overlooked.

There is often a contrast between the temperature and the "frequency of the pulse;" though, as a rule, slight febrile heat coincides with a pulse of 80°—90°; moderate fever with 90°—108°; considerable fever with 108°—120°; extreme heat with 120° and upward per minute.

[According to Aitken, in "Science and Practice of Medicine," an increase of one degree F. above 98° corresponds with an increase of ten beats of the pulse per minute, as below:—

Fahr.	Cent.	Corr'g pulse.	Fahr.	Cent.	Corr'g pulse.
98	36.6	60	103	39.5	110
99	37.2	70	104	40.0	120
100	37.8	80	105	40.6	130
101	38.4	90	106	41.1	140
102	38.9	100			

According to Liebermeister :—

98.6	37	78.6	104.0	40	105.3
100.4	38	88.1	105.8	41	109.6
102.2	39	97.2	107.6	42	121.7

Both statements agreeing with Wunderlich's.—W. B. Woodman.]

Otherwise their "relation" stands thus :—the pulse follows the temperature when there is improvement, and precedes it in exacerbations.

In children and nervous persons this relation is altered by the greater frequency of the pulse.

Meanings of "other discrepancies" of these signs:— A pulse rather slow in proportion to the temperature is favorable as indicating a tranquil nervous system. A low pulse with high temperature invites us to look for some spinal cause, as pressure on the brain, depressing action of drugs, etc. Contrarily, a low temperature and frequent pulse points to local complications in the thorax or pelvis. Not forgetting, however, that moving accelerates the pulse of patients ; altogether the frequency of the pulse is a bad gauge of the amount of fever.

The "number of respirations" per minute does not correspond so closely to the temperature as the frequency of the pulse. In collapse, there is often (not always) a frequency of respiration ; and in slight fever of childhood also ; in moderate fever the respirations amount to 20 or so per minute ; in children to 40 or 50. In considerable or ex-

treme degrees of fever they are higher yet, 60 in many cases; movement, also, increases their frequency. In other cases a quickened respiration indicates local causes.

Between the temperature and "cerebral symptoms" there is sometimes a concordance, sometimes a contrast. The brain symptoms accompanying fever are slight in grown people, and deep or serious in children and old persons. In adults delirium occurs with very high degrees of fever; if it is observed when the temperature is low, we must attribute it to a local affection. When the temperature is in the process of falling (as in collapse or defervescence), fierce delirium and maniacal outbreaks may appear, either of little import or similar to those preceding the death-agony. The distinction must be made upon other grounds than the temperature and the delirium.

"Significance of the result of a single thermometric observation in a person considered healthy." In the healthy the fluctuations are very trifling; yet, during menstruation, lying-in, suckling, dentition, rapid growth, bodily fatigue, mental depression, etc., temperature is often increased. Its maintenance near the normal point in these conditions is a capital guaranty of the capacity of endurance of the organism. A subnormal temperature in apparently healthy people is suspicious; the commonest deviation, a subfebrile temperature, indicates at least a morbid susceptibility. In children, particularly the youngest, this is caused by external influences, as excessive movement; in adults, particularly in the robust, it indicates some latent mischief, and invites an examination of the lungs, heart, etc., and a reapplication of the thermometer, and a vigilant supervision of the vital signs.

Significance of "a single observation of temperature in cases of apparently slight indisposition." In such cases, thermometry offers a rapid and striking method of acquir-

ing information. When the temperature is found normal, the slight character of the illness is confirmed (yet it is well to repeat the observation a few hours afterwards). Even subnormal or subfebrile temperatures do not denote a serious malady, provided the observation is not taken at the beginning of a disorder. But inside of the fever-limits, vigilance is necessary, though in children, women, consumptives, etc., this excess of temperature may prove transitory. But a very high temperature must always prepare our minds for serious developments. Send the patient to bed and let him be watchfully nursed.

A diagnosis is seldom possible at the "very commencement of an acute" febrile disease. Proceeding by exclusion, a normal temperature, or a moderate fever, excludes true pneumonia, small-pox, scarlatina, typhoid fever; a high fever at the onset, precludes typhoid fever, influenza (grippe), articular rheumatism; but, with the concurrence of other symptoms, opens the "area of probabilities" to exanthemata, acute tonsillitis, pneumonia, pleurisy, intermittent and ephemeral fevers, pyæmia, meningitis of the convexity of the brain, typhus, etc.

The diagnosis of an acute disease is still very doubtful "during the first half of the first week," unless thermometry can assist in making it at the first observation, which it cannot always do.

"Subnormal and collapse" temperatures only occur in diarrhœa, cholera, hæmorrhages, perforations, toxic gastritis, etc.

In the early days, a "normal evening temperature" suggests the idea of intermittent fevers. But if the "morning temperature" is also found normal (unless some special circumstance keeps it low), we may almost conclude that there is no disease. However, catarrhal affections, measles, pleurisy, acute tuberculosis, granular meningitis, and

acute rheumatism may be present with a normal morning temperature; whilst subfebrile or slightly elevated febrile movements have about the same significance. A high febrile temperature the first or second day, particularly in the morning, precludes the idea of typhoid fever, or proves that it began longer ago than indicated by the other symptoms.

To conclude: a single observation indicating a high degree of fever, scarcely allows us to form a conclusion as to the kind of morbid process which is going on for the first few days; but if we are able to exclude the possibility of an intermittent fever, we may with great probability expect a severe illness.

Even in the "second half of the first week" of a febrile illness, the diagnosis may remain very uncertain in the prodromal fever of exanthemata, typhus, typhoid, and relapsing fevers, tardy pneumonia, etc., in which a solitary reading of temperature conveys but scanty information. But if this isolated reading shows an evening temperature normal, subfebrile, or hardly high (without depressing influences), there is no exanthematic nor typhus fever; if a high fever, we may exclude tubercular meningitis; if hyper-pyretic temperature, we are warned of masked intermittent and other malignant or infectious diseases; thermometry must be persevered in before forming hasty conclusions from its first application.

When an exanthematic eruption appears, with yet doubtful characters, if the temperature (previously high) becomes low, it is the small-pox; if normal, it is the varioloid; if it falls (but from a previously small height), it is a syphilitic exanthem; if it does not abate after the apparition of the eruption, it will prove to be the measles, scarlatina, or typhus.

During the further course of an acute febrile disease, when

its diagnosis is uncertain, or appears so, the temperature continues to afford the most important information, and the observations must be continued. Yet, even then a single observation may be of great value: it may remove a doubt, decide on the severity of the disease, indicate its modifications, as well as the danger and possible complications of it. It is thus that we can hardly admit the presence of typhoid fever when at any time, between the third and tenth day, the temperature is not somewhat febrile, and considerably so in the evening; that a low temperature, contrasting strongly with the high previous ones, raises the suspicion of internal hemorrhage before any blood has appeared; and that, even later in the third week, typhoid fever is doubtful if the evening temperature (accidents excepted) is less than 39° C.=102.2° F., etc. But a high morning temperature of 40° C.=104° F., or an evening one of 41° C.=105.8° F., are signs of great severity; and a normal temperature in the morning at a later period, is no proof that the fever is over, if it still continues to rise in the evening.

When the temperature remains febrile after the eruption begins to fade in "measles," and little later in "scarlatina," it threatens complications; in "small-pox" the same symptom precedes the suppurative fever or complications.

In (true) "lobar pneumonia" a single normal or subfebrile temperature is no proof that the process is over. All high febrile temperatures in pneumonia are severe symptoms; more so after the sixth day; though a striking rise of temperature sometimes precedes the favorable crisis. In spite of other alarming symptoms a normal, or subfebrile temperature at a later period promises recovery.

In "facial erysipelas," a febrile temperature announces further extension or complications.

In "influenza and bronchitis" high fever, in the morning or late in the disease, indicates extension to the finer bronchi, supervention of pneumonia, or masked deposits of gray or miliary tubercle. In whooping-cough, complications are to be expected from high fever in the second period.

In acute articular rheumatism a single observation is useless, unless it shows a very high temperature, which is dangerous.

A high temperature in meningitis points out the seat at the convexity or summit of the brain; contrarily, a weak apyretic temperature indicates granular meningitis of the base; but temperature may reach almost to any height in cerebro-spinal meningitis.

A high temperature, at any time, indicates great danger in pleurisy, pericarditis, endocarditis, peritonitis, while a moderate or apyretic one does not insure a favorable prognosis.

In presence of a "gastro-intestinal catarrh," if the patient has been in good condition and not exposed, a single observation showing a high temperature, excites a suspicion of "typhoid fever;" yet a second observation of high temperature is necessary to make it certain.

The diagnosis of "intermittent fever" is doubtful if the temperature, at the conclusion of the cold stage, or at the commencement of the hot, does not reach 41° C.=105.8° F., or if it exceeds 41.8° C.=107.24° F., or if it is not normal in the intermissions. Although the "paroxysms" may have ceased with the other symptoms, as long as the temperature remains febrile, the intermittent is not cured.

During "defervescence," isolated observations afford no satisfactory results, although a low evening temperature would be proof of the cessation of fever. When fever is about to leave, after a severe illness, the temperature rises

and falls sometimes alarmingly in weak, sensitive patients; the closer to the crisis, the less dangerous are these collapses of defervescence.

After the termination of the disease, and in true "convalescence," the temperature is normal, or transitory collapse-temperatures may occur. The latter may be caused by internal hæmorrhage or perforation of the bowels. Otherwise simple subnormal temperature indicates, if not danger, unsettled convalescence and deficiency of nutrition. The more mobile the temperature, the more unsettled the convalescence.

"Febrile temperature" in convalescence may be caused by error of diet in regard to quantity, strong meat or drink, exertion, and leaving the bed too soon, constipation, external influences, complications or extensions of the primary affection, or a new one.

A single temperature taken during a "great change" in a fever, may decide the tendency to a fatal termination. In a disease "without febrile character," if the thermometer discovers an elevated temperature, it is noteworthy. In "nervous affections" hyperpyrexy may indicate supervening disorders or fatal termination.

In "jaundice" a high temperature is suspicious. In diseases accompanied with vomiting, diarrhœa, and particularly collapse, a febrile temperature of the trunk indicates the commencement of reaction. If such temperature persists it may indicate exacerbation or complication.

In "chronic diseases with persistent fever" a single observation cannot detect anything; the observation must be continuous; but it can detect collapse-temperatures, which are more significant here than in acute cases.

CHAPTER X.

DAILY FLUCTUATIONS OF TEMPERATURE IN DISEASE.

In disease, the "height" of the temperature varies more or less in the course of one day; observations representing it as stationary are to be disregarded. The daily fluctuations of health are more marked in disease, where they range from 1°—1.5° C.=1.8°—2.7° F., even 5°—6° C.=9°—10.8° F., or more. When the temperature is high and the daily variations slight, the disease will be severe and lasting. The daily fluctuations in different diseases, and in different patients from the same disease, assume different forms, yet agree in some points regulated by certain laws. These fluctuations drawn diagrammatically take the form of waves composed of crests and furrows. Each daily fluctuation is found to be a curve, composed of several secondary ones. To understand a daily fluctuation several observations are necessary, two to four during the exacerbations and remissions, or more, or even continuous, to follow the thermal law of the case.

The average of all the temperatures taken in a day, or adding the minimum to the maximum and dividing by two, form the *mean daily temperature*. The *daily difference* is the extent of the *excursus* between the *maximum* and *minimum* temperatures of the day. The elevations above the mean daily temperature are *exacerbations*, the depressions below it, *remissions*. The highest point of exacerbation just before a fall is the *acme*. The exacerbation which falls suddenly is said to be *pointed* or *acute*, the one which lingers at the *acme* before sinking is *broad-*

topped; this may show a sinuous outline called double or triple-*peaked* exacerbation; the highest is the *maximum* of the exacerbation. The maximum of several exacerbations may not correspond with the maximum of the day. The lowest point in a remission is its *depth* or *nadir*. If there are several, the lowest corresponds with the day's minimum. The time occupied by the rising of the temperature above its daily mean, and its coming again to it, is the *extent* of the exacerbation; the same movement downward is the extent of the remission. The moment the temperature rises from the *nadir*, it has begun its daily ascension, moderate, tedious, interrupted, extreme, or sudden. The daily *descent* begins from the last point of the exacerbation, even if it is not the highest, gradual, interrupted, slow, or rapid: there are, in a day, as many exacerbations as remissions.

The form assumed by the "daily fluctuations" depends upon the elements which constitute the morbid process, and chiefly on the kind of disease, its intensity, the stage it has reached, the regularity, irregularity, or other peculiarities of its course, the improvements or relapses, the occurrence of complications or special events, the progress toward health, the fatal crisis. It may also depend on the idiosyncrasy of the patient, interstitial or external influences, therapeutic agencies. Thus the "daily fluctuations" exhibit very complex phenomena; notwithstanding, they furnish valuable indications.

A single day's fluctuation may suffice to determine the degree of "severity" of a disease, and the "stage" of some of them; but we must compare the variations and repetitions of these fluctuations during a certain number of days in order to form a safe diagnosis and prognosis, to decide as to ameliorations and relapses, to the operation of accidental causes, and to the action of therapeutic agents.

Among the conclusions to be drawn from the average temperature of a single day, is the important one of the "level," if it is high, medium, or low. Whilst the base line of daily fluctuations is 37° C.=98.6° F., it is seldom so low, ordinarily more elevated in disease. It is below the "level" in cholera, the sinking stage of some diseases, some collapses, and transitorily in defervescence.

The daily mean temperature furnishes at once indications as to the degree of fever present. In moderate fever the mean daily temperature does not exceed 39° C.= 102.2° F. In somewhat high fever 39°—40° C.=102.2°—104° F., this includes remittent types with a mean of 39°—39.5° C.=102.2—103.1°, and continuous fevers with a mean of 39.5°—40° C.=103.1—°104° F. It shows high fever above 40° C.=104° F.; many diagnostic and prognostic conclusions depend upon this.

Highly febrile daily means, above 40° C.=104° F., are met with in pernicious (malarial) fevers, typhus and typhoid in their fastigium, in relapsing fever, in severe pneumonia, which may recover; but in other diseases this average makes death imminent.

A considerably febrile daily mean (39°—40° C.=102.2° —104° F.), met with in well-developed pyrexia and in the fastigium of inflammations, deserves consideration, particularly in catarrhs, acute polyarticular rheumatism, cerebro-spinal meningitis, neuroses, post-choleraic stage, trichinosis, diphtheria, dysentery, pleurisy, pericarditis, peritonitis, and all affections suspected to be tubercular or phthisical.

A moderately febrile mean (39° C.=102.2° F.) has a varied significance, as it occurs in continued or remittent febrile diseases, in their rudimentary state, in their beginning, or in their favorable crisis; but chiefly in cases in which in a single day the temperature sinks from high to

normal or subnormal, after an uncompensated fall as in collapse, etc., in inflammation of the serous membranes, and in death-agony, when brought on by pressure on the brain, inanition, etc. When the daily mean is much affected by circumstances or medication, we must be cautious about conclusions.

The "daily difference," or "extent of the excursus" between the minimum and maximum of the day, may vary greatly; and even when it embraces the same number of degrees in a high, and in a low mean daily, its signification changes entirely. In a daily mean of 37° C. =98.6° F., a daily excursus of 1° C.=1.8 F. is of no importance; but one of 1.5° C.=2.7° F. is suspicious. With a daily mean of 37.5° C.=95.5° F., a daily excursus of 1° C.=1.8° F. indicates a certain disorder; and 1.5°C= 2.7° F. indicates a disease, if not always a febrile one.

The "daily difference" grows in importance as the "daily mean temperature" becomes higher. The latter being 38.5 C.=101.3° F., a daily difference of less than .5° C.=.9° F. indicates a continuous fever; and less than 1° C.=1.8° F. a subcontinuous; and a greater daily difference with a daily minimum of 39.5 C.=99·5 F. indicates a remittent type. But when the daily minimum remains high, an exacerbation of about 1° C.=1.8° F. shows a high degree of fever with no sign yet of favorable termination; it is denominated "exacerbating daily fluctuation."

If the "daily minimum" reaches the normal temperature, there is a true "intermission," though we class the case as remittent, not intermittent; and if it reaches the subnormal, we class it as intermittent, though through great exacerbations the daily difference may be 6° C.= 10.8° F. But "intermissions" are considered *real* only when all the symptoms of fever abate, and their return assumes the proxysmal form; they are founded not upon

a single day's observation, but on the observations of the whole course of the disease. (See next chapter.)

The occurrence of remissions at the height of an illness, indicates improvement, transition towards convalescence; its continuance, with an increase in the amount of "daily difference," confirms the progress of convalescence; the opposite signs indicate relapse or complication. When, in acute diseases, the difference becomes greater, by the fall of the "daily minima," convalescence is progressing; but when the difference is greater (forming more acuminated peaks), with rising daily mean temperature, the patient is getting worse. When the difference is augmented, through the temperature becoming subnormal in remissions, it is either favorable, indifferent, or dangerous. When the remissions are unduly protracted (the patient seeming convalescent in all other respects), it shows that the disease has yet a hold upon him. Decreasing differences with decreasing daily means is favorable; decreasing difference with increasing mean temperature is dangerous; whilst decreasing difference with stationary means is of doubtful significance. But the differences may remain the same, in spite of the progress or diminution of the disease, because the exacerbations rise to a height corresponding to the fall of the remissions (stationary difference with increasing means); or by the exacerbations decreasing in proportion to the increasing depth of the remissions (stationary difference with decreasing means).

The "daily difference" is usually slight in very severe typhoid fever, in typhus, in the prodromes of small-pox, in the height of scarlatina, in the majority of lobar (true) or croup-like pneumonia, in the last stage of acute fatty degeneration, in facial erysipelas, in meningitis of the convexity of the brain, and in the last stage of fatally ending neurosis.

On the other hand, the "daily differences" are generally considerable in moderate or medium typhoid fever, in the first days of a severe attack, and again in its convalescence; sometimes in the convalescence of true typhus, in the convalescence of small-pox and its allies, measles and all catarrhal affections, acute polyarticular rheumatism, basilar meningitis, acute tuberculosis, pleurisy, pericarditis, acute and chronic suppurations, pyæmia, the various forms of phthisis, and trichinosis.

"Daily differences," which alternate between normal or subnormal, and considerable or high febrile temperatures, occur in the advanced stage of recovering typhoid, sometimes in the suppurative stage of small-pox and its allies, at the end of lobar pneumonia, in all malarial diseases, in pyæmia and septicæmia, acute tuberculosis, and chronic forms of fever. Such a change may also occur in the course of a single day's fluctuation, through some special occurrence, like hæmorrhages, etc. Daily differences between moderately high and normal or subnormal temperatures, are frequent in fevers of moderate severity and protracted defervescence.

In the majority of cases there is in a day (24 hours) only one exacerbation with one, two, or three peaks, and one remission with one minimal descent. This is the simplest and commonest form; but in complicated intermittent the entire fluctuation comprising paroxysm and intermission lasts 48 hours (the tertian type).

Generally the remission begins between the late evening and early morning, and the daily maximum begins late in the morning or in the afternoon. The morning remission generally reaches its lowest point from 6 to 9 A.M., and the daily maximum its highest from 3 to 6 P.M., but both extend several hours more. Such is the common course, yet we meet with cases in which, without altering

the result, the exacerbations occur in the morning and the remissions in the evening.

In "collapse," also, we meet with extraordinary low minimums in the evening.

"The time at which the daily maximum and minimum occur" may have a meaning. The early (noon) maximum is a sign that the disease is severe and at its height; whilst a late maximum indicates that the disease was trifling or has moderated. An early minimum is considered an improvement, unless brought on by collapse.

Far more important than the moment at which the maximum or minimum is reached, is the moment when the daily rise of temperature begins (ascent), and the other moment when the temperature begins to fall (daily descent). The more punctually (supposing no external disturbance) the ascent begins every day, the more intense is the disease, and remote the cure. It is a bad sign when the morning rise begins before 9 A.M.; and worse if it begins earlier from day to day. A postponement of the ascent shortens the exacerbation and is favorable, even if the daily maximum is not diminished thereby; contrarily, the later the exacerbation declines, the more severe the disease.

The "suddenness" of the rise and fall may offer indications, in connection with extreme "daily differences." The first rise of a few tenths of temperature occupy some hours, then it becomes very rapid in the middle, and ends as it began, very slowly.

An unusually rapid rise occurs in the early stage of acute diseases. Before a favorable crisis, a protracted rise of temperature, the last of its kind, often precedes defervescence: this ascent is sometimes broken by a short descent. A very rapid fall of temperature may precede convalescence, or mark collapse. A very slow fall threatens im-

perfect or absent remission for the morrow. Defervescence may be inferred when the morning fall, interrupted in the afternoon, resumes its descent in the evening. In somewhat severe fevers, the temperature lingers less in the low than in the high temperatures; it is therefore a favorable sign when the peaks are quickly attained and suddenly deserted.

The duration of the variations of temperature *above* the daily average is the "latitude of exacerbations," and the corresponding movement *below* the daily average is the "latitude of remission." If the former be longer than the latter, the case is judged severe; the more so at a late period of the disease. When recovery comes, equality is more marked between the two "latitudes." In advanced convalescence the "curves of the remissions" become *broader*, "those of the exacerbations" more *pointed*. Exacerbations of great extent have double or multiple summits; in the double peaked one, the highest is that of the evening. They begin at noon, not in the morning. These many-crested fluctuations are unfavorable.

In many forms of disease presenting complexity, two or more exacerbations succeed one another in the course of twenty-four hours—"duplex and triplex exacerbations"—and are closely related to the multiple-peaked ones, just described. Their meaning varies according to the degree of daily difference, the type of the fever, in proportion to the height (or lowness) of the daily mean temperature, to the tendency to a rise or fall of temperature, or to actual defervescence. But in fevers continuously high, the daily waves furnish little if any information.

In the pro-agonistic stage the fluctuations are wavy; let us not be deceived by them.

CHAPTER XI.

THE COURSE OF TEMPERATURE IN FEBRILE DISEASES.

In febrile diseases, the temperature exhibits rules which are common, and differences which furnish the data to distinguish their forms and varieties.

The temperature may remain continuously above the normal, till it has reached its maximum, or only descend below it from some accidental circumstance, whence it speedily regains its normal height:=*continued* fever. Or the elevations of temperature are interrupted once, or several times:=*intermittent* and *relapsing* fevers. In such cases, each interval of time, separated by the apyrexia, may be regarded as a fever in itself.

Sometimes the fever is like a "part of the disease," at other times "accessory" or corollary to it: a great difference, since the course of the disease is affected by the type in the former, by the circumstances in the latter. The diseases in which the fever is essential are principally those with a "well-marked type;" those in which the fever is occasional, are mainly "atypical."

The course pursued by the temperature in a given affection may be determined by "the nature of the disease:" the more typical the form, the stronger its influence on the course of the temperature; this influence is not the only one, but the greatest; by "the intensity of the disease:" even in typical forms this modifies the course of the temperature; "individual circumstances" in children heighten the temperature, in aged persons lower it; hysterical temperament, etc., modifies it. It is changed by

"accidental influences," which operate in proportion to their potency, but more on atypical than on typical forms; by "complications," which, supervening in a disease, modify the course of its temperature, sometimes obliterate the original type of it, sometimes introduce instead their own.

The course of temperature in febrile diseases may be divided into a number of "periods" or "stages," which vary much in their significance; they are sometimes strongly marked, at other times very indistinct.

The "pyrogenetic stage," or initial period, assumes various "forms," depending mainly on the fever preceding

Fig. 3.

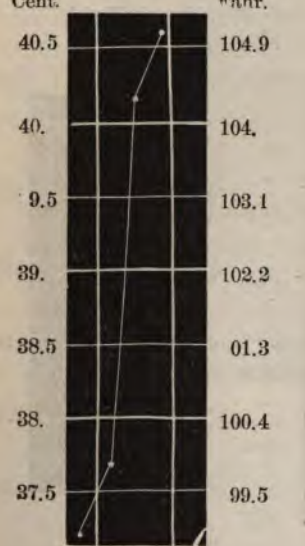
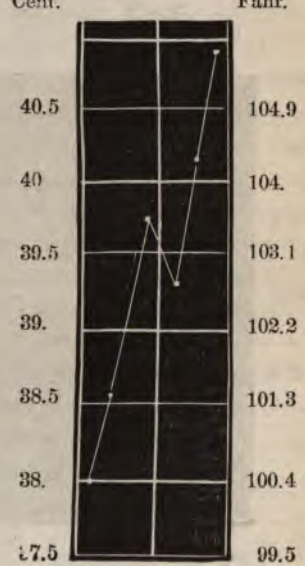


Fig. 4.



the local affection, or succeeding it, or running its course independently.

There are forms of disease with a "short pyrogenic stage," in which the temperature rises suddenly in one line, or almost so, to its characteristic height in a few hours, a day, or one day and a half. (See Figs. 3 and 4.)

In these cases the forearms, hands, legs, feet, and face even, are cold, whilst the warmth of the trunk has risen considerably; there is chilliness, shivering, chattering of the teeth, till the extremities have approximated to the elevated temperature of the trunk. Attacks of illness, which begin with a short pyrogenic stage, have but short paroxysms of fever, with a sharp elevation of temperature, and a continuous course ending in less than a week by a rapid fall of temperature, or death.

Fig. 5.

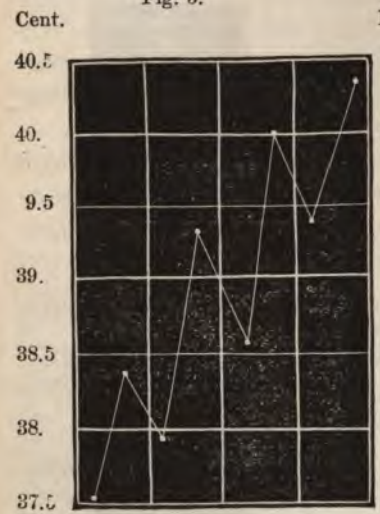


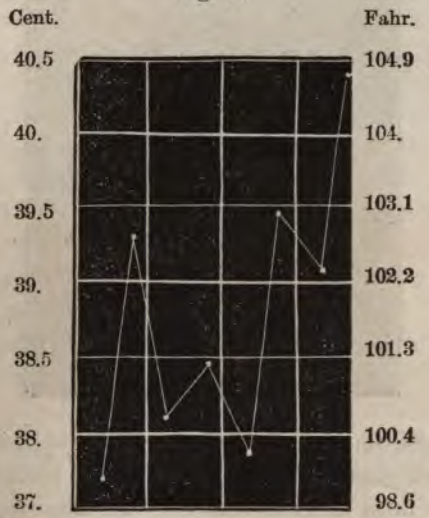
Fig. 6.

This kind of "initial stage" is the rule in variolous affections, scarlatina, croup-like pneumonia, pyæmia, malarial and relapsing fever; it is common in typhus, febri-

cula, facial erysipelas, tonsillar angina, meningitis of the convexity. It never occurs in typhoid fever, basilar meningitis, catarrhal affections, nor in acute polyarticular rheumatism.

There are other forms of disease with "protracted pyrogenic stage," in which the temperature begins to ascend in the evening; the next morning it moderates, and rises more the following evening (Fig. 5). It may

Fig. 7.



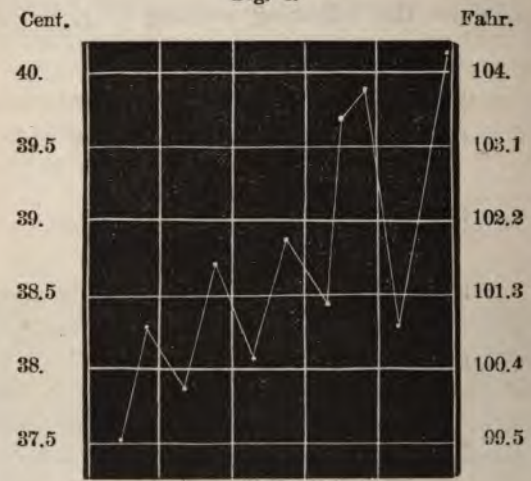
thus happen that the normal temperature is again reached in the morning of the second day (Fig. 6), or even that the initial stage is interrupted by a still longer interval of apyrexia (Fig. 7).

In this type the initial stage lasts several days, seldom more than a week. The height of the temperature indicates the severity of the disease, and suffices to establish the diagnosis of typhoid fever, other symptoms concord-

ing. Otherwise this protracted stage is initial to other affections—measles, catarrhal pneumonia, etc. (a class already enumerated).

There is also the "insidious initial stage," which does not conform to rules, and whose type can only be approximated, as in Fig. 8. It initiates acute rheumatism,

Fig. 8.



pleurisy, lues, phthisis, and numerous atypical affections.

The "fastigium," or "acmé," is the period in which the fever is most fully developed. At this stage the temperature experiences great variations from the many influences which affect the fever.

The "variations of the height of the temperature in the fastigium" are relative to the "height of the maximum temperature," or highest point reached in a given case, which depends partly on the kind of disease, partly on its severity; but is not absolutely reliable in diagnosis, because it is sometimes brought to an unusual degree by

collateral or accidental circumstances. The "lower range of the maxima" is also not absolutely reliable, because its observation may have not been taken at the opportune time; yet, for example, one can pronounce against the existence of intermittent fever after a careful observation, showing that the temperature never reached the lower range of maximum of this disease; or we may exclude typhus and typhoid fever if a temperature of 39.5° C.= 103.1° F. has never been met with.

But the "variations" in the "height of the daily means," or average daily temperature, are far more important *per se*, though they, too, are influenced by the severity of the disease, circumstances, etc. The "height of the daily means" is somewhat as follows in the fastigium of:—Typhoid fever, 39°—40.2° C.=102.2°—104.36° F.; typhus, 39.2°—40.5° C.=102.56—104.9 F.; eruptive fevers, small-pox, etc., 39°—40° C.=102.2—104° F.; measles somewhat lower, on account of the extent of the morning remissions; regular scarlatina, 40° C.=104° F.; croup-like pneumonia, 39.2°—40° C.=102.56°—104° F.; meningitis of the convexity, 40° C.=104° F. or more; articular rheumatism, without complication, 38.5°—39.5° C.=101.3—103.1° F.; acute influenza, 38.5°—39.2° C. =101.3°—102.56° F.; facial erysipelas, 39.5°—40° C.= 103.1°—104° F.; parenchymatous tonsillitis, about 39.5° C.=103.1° F.

When this stage is short, the "average height of the fastigium" may be easily modified by circumstances, as one accidental remission or exacerbation, in which case we must disregard the mean obtained from them, in determining the intensity of the disease.

The most "valuable data" for diagnosis and prognosis are obtained from the "general course" of the temperature during the "fastigium." Its form on a chart is

"acuminated" (pyramidal), reaching rapidly to a point from which it rapidly falls, or where it ends fatally; or "continuous," persistent at a certain height, with or without slight fluctuations; or "interrupted," broken by considerable fluctuations in a single day, or by strong differences in several.

The "acuminated" course of temperature during the fastigium occurs in the paroxysm of short intermittent, in ephemeral, and malarial fevers, pyæmia, erratic erysipelas, seldom in pneumonia; in fever accompanying her-

Fig. 9.

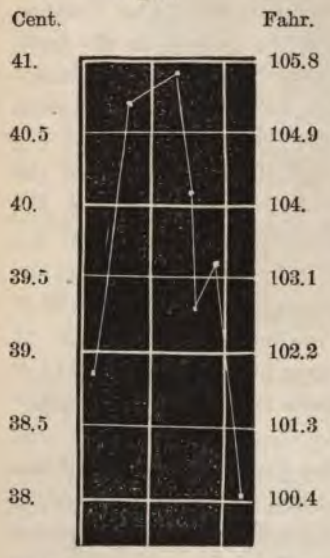
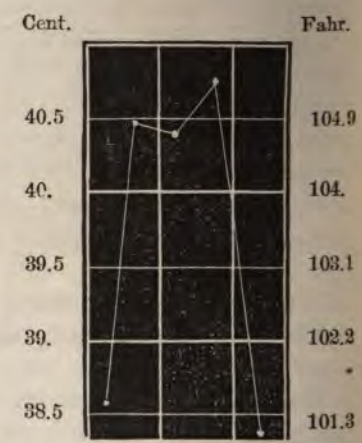


Fig. 10.



petic eruptions and tuberculosis, and in terminal fevers generally. The fastigium may thus exhibit a single pointed summit (Fig. 9), a broad-topped maximum (Fig. 10), or several peaks (Fig. 11).

Lasting only a few hours, and rarely more than a day,

the pyramidal fastigium either ends in death, as per Fig. 12, or falls quickly after reaching the acmé; two or more

Fig. 11.

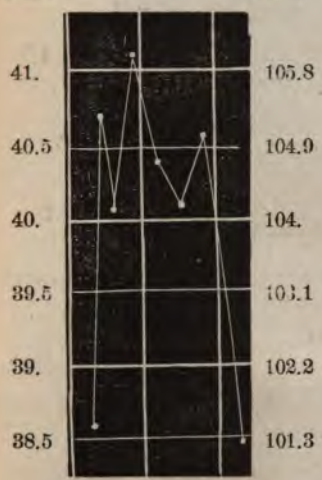
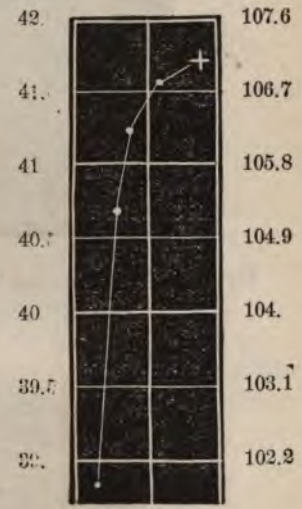


Fig. 12.

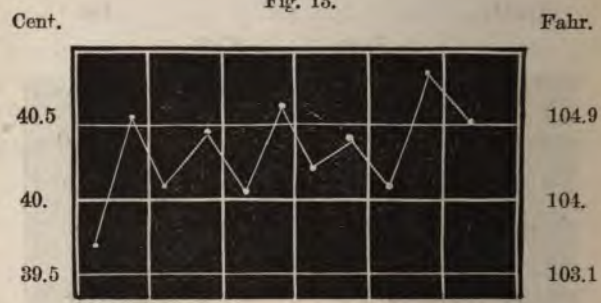


such attacks follow, as in malarial, intermittent pneumonia, etc.; in these abrupt fevers a relapse is frequent.

"A continuous course" is not always even, but may be undulated by slight fluctuations of .5° C.=.9° F., or a little more (see Fig. 13). It occurs in the fastigium of severe acute diseases; in severe complications, and in very mild miscellaneous cases. The diseases which seem to have a predilection for this kind of fastigium are typhus, scarlatina, croup-like (true) pneumonia, the prodromal stages of variola and its allies, erysipelas before it spreads, meningitis of the convexity, severe general febrile affections, showing microsopic lesions, or having a short initial stage of rigors. When diseases, which usually exhibit the remit-

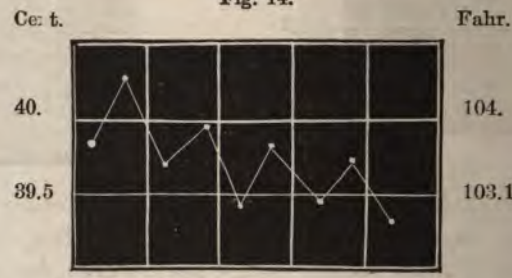
tent or non-continuous course, assume this continuous fastigium, it is an unfavorable symptom.

Fig. 13.



Here, the height of the average temperature is import-

Fig. 14.

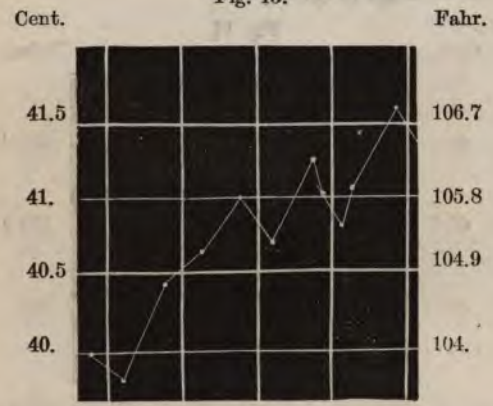


ant; its continuous course is either ascending (Fig. 15), a bad sign; descending, a good sign (Fig. 14); or persistent on the same level, neutral. Usually the first part is more severe, the second milder. These parts are often divided by a fall of temperature, a "pseudo-crisis." This continuous course of temperature during the fastigium very seldom lasts more than a week, but it may be repeated in a moderate or "remittent" form.

In the great majority of diseases the course of tem-

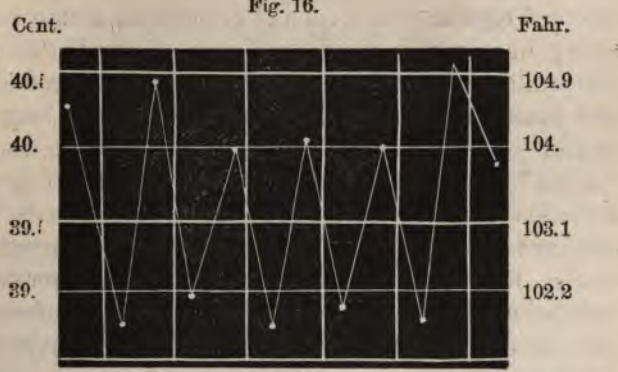
perature is "noncontinuous" during the fastigium. This is the rule in typhoid fever, catarrhal affections,

Fig. 15.



catarrhal and putrid pneumonia, measles, osteo-myelitis, meningitis, pyæmia, lues, etc. The fluctuations between

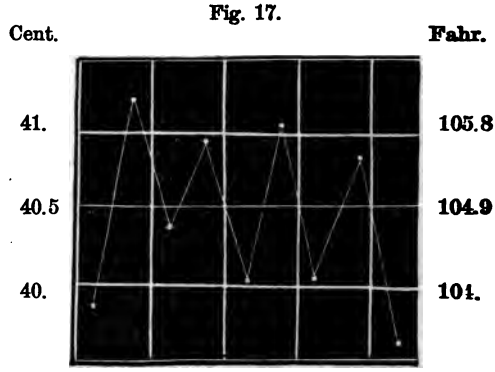
Fig. 16.



evening exacerbations and morning remissions may be considerable, therefore varying much the "daily maxima.' In cases of moderate severity the morning remissions fall

more or less below the average height of the fastigium of the disease (Fig. 16); whilst in severe cases they remain above that average (Fig. 17).

Fig. 17.

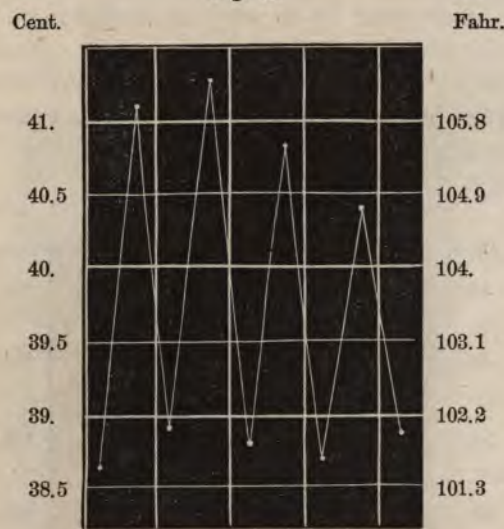


The extent or "excursus of the fluctuations" betwe en the morning and evening temperature may range from .8° to 3° or 4° Cent.=1.35°—5.4°—7.2 F. (See Fig. 18.) The alternations between exacerbations and remissions may be repeated regularly for days and even weeks, almost identically; but in the "non-continuous course" the daily temperature may show more irregularities; as remissions and exacerbations occurring earlier or later, longer or shorter on a given day; non-concordance between the "depth" of the remissions and the "height" of the exacerbations; intercurrent "retrograde movements," isolated and powerful "falls," or "elevations" of temperature, rarely favorable symptoms; occasional intercurrent "elevations" of temperature due to some unfavorable development or complication; and more rarely in intercurrent collapse.

Often these irregularities combine by two or more, and a type once broken by them is seldom resumed; they are frequent in pyæmia.

The "varieties in the non-continuous course of temperature during the fastigium" result mostly from the nature and severity of the disease, and sometimes from complications. Typhoid fever is the most typical of all the diseases with non-continuous fastigium. The mini-

Fig. 18.



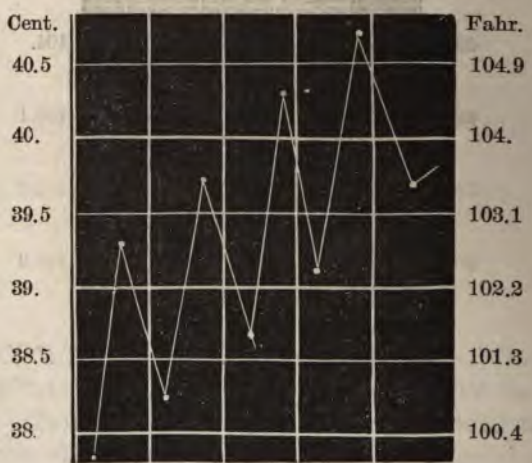
mum of its exacerbations is 39.5° C.=103.1° F. The limits of its daily excursions does not exceed 1.5° C.=2.7 F. Its course is regular (when uncomplicated). Its fastigium is never less than eight, nor more than seventeen days; even circumstances do not easily affect its temperature, still less its duration.

The "absolute height of the maxima of exacerbation" is considerable in the non-continuous part of recurrent or suppurating fever, variola, catarrhal pneumonia, etc. (as *supra*). On the other hand, it depends more upon the

severity of the individual case in the opposite series, polyarticular rheumatism, pleurisy, etc.

The "daily difference" or "width of excursus of the fluctuations" depends on the form and severity of the disease. Sometimes the excursus is as extensive as in intermittent, sometimes as limited as in continuous fever. The latter are often severe; the former, with high exacerbations, may lead us to suspect malignancy, pyæmic or septic infection, embolism, secondary deposits, etc., though some cases may recover without confirming or invalidating the suspicion, nor revealing the cause of such an extreme course of the temperature.

Fig. 19.

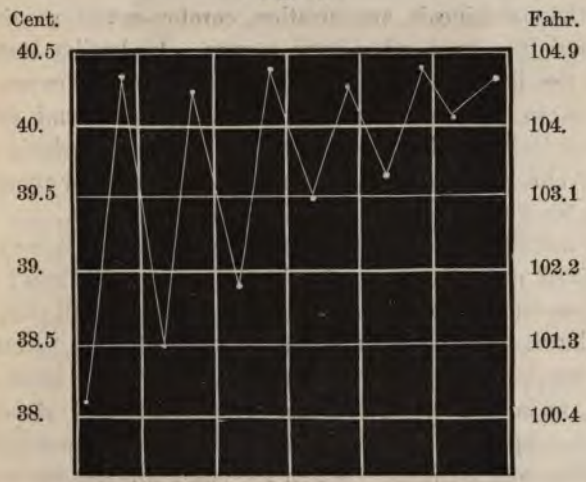


With the disposition of non-continuous fever to irregularities, any special event in the course of the disease, such as the action of calomel, digitalis, cold water, etc., may produce sudden plunges, elevations, or collapse.

The "direction taken by the temperature" when the

course is non-continuous may likewise differ, the fastigium being either "uniform," "ascending," or "descending," rather corresponding in this respect to the dangerousness of the disease. The "ascending" direction may consist in an increase in the height of the daily average of temperature (Fig. 19); or in the "remitting type" approximating to a "continuous or exacerbating" one (Fig. 20).

Fig. 20.



The "descending" fastigium is recognized by a contrary march, which usually effects a gradual, rarely a sudden, fall, preceded by brief irregularities.

The fastigium may be broken in two periods of a whole or half week. If an ascending direction is succeeded by a uniform course, and then a descent, it warrants a favorable prognosis; but if a uniform march assumes an ascending direction, the case is bad.

The "duration" of the fastigium is longer in the non-continuous type than in the continuous; shorter (if not

suddenly fatal), it indicates less severity; longer, more. The prodromal stage of measles, in favorable cases, has a particularly short fastigium. In influenza, bronchitis, cynanche tonsillaris, parotitis, catarrhal pneumonia, wandering erysipelas, suppurating fever of small-pox, peritonitis, reactive fever from cholera, the fastigium cannot last more than five or six days without danger; in typhoid fever, eight to seventeen.

The fastigium lasts longer in polyarticular rheumatism, pleurisy, trichinosis, suppuration, cerebro-spinal meningitis, and lues, even when cure ensues. In basilar meningitis the length of the fastigium has no significance in regard to the issue; in septicæmia, pyæmia, and acute tuberculosis it rather has a favorable one. In phthisis and other chronic affections, the fever may persist for months, even for years, without much affecting the issue.

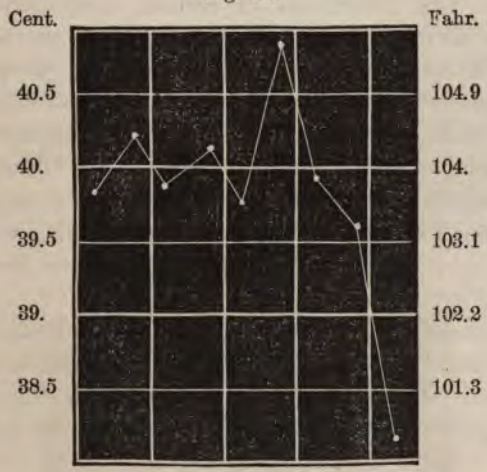
In most diseases the fastigium is simple; but it may be repeated more than once in the following affections: the relapses of typhoid fever, relapsing fever, small-pox, irregular exanthems, pneumonia (relapsing forms), pyæmia, and septicæmia (with apparent improvements intervening), facial (relapsing) erysipelas, polyarticular rheumatism (complicated), basilar and cerebro-spinal meningitis, pleurisy, and phthisis. When the fastigium repeats itself, continuous, remittent, and paroxysmal types may follow each other; the more continuously elevated becomes the fastigium, the more unpromising the case.

The "close of the fastigium" is sometimes clearly defined, sometimes indistinctly, merging into the following stages, or a brief rise may terminate it; called by the physicians of old times *perturbatio critica*. (See Fig. 21.)

In small-pox the fastigium ends as soon as the eruption becomes "shotty;" in measles it terminates when the eruption is at its height; in scarlatina, when the exan-

them begins to pale; in pneumonia, when hepatization is completed, between the third and ninth day; in typhus, towards the end of the second week or the middle of the third; in mild typhoid fever, in the course of the second week, and in severe cases in the course of the third or

Fig. 21.



fourth; in influenza it lasts a few days; in parenchymatous tonsillar angina, three to seven days; in other diseases the termination is more or less uncertain.

Most of the diseases have completed their evolution at the end of the fastigium by death or convalescence; others continue, after it, in a state of indecision—an "amphibolic stage." This stage is most strikingly severe in typhoid fever; occurring also in lingering pneumonia, typhus, polyarticular rheumatism, epidemic cerebro-spinal meningitis; and is marked by great irregularities of temperature, which, however, seldom reach the maximal height of the fastigium. It may last more than a week, and

lingers longest in grave typhoid cases. Intermittent collapse is often met in this period.

Certain "influences" may modify the fastigium or the amphybolic stage. A "rise of temperature" is induced in febrile patients by mental excitement, bodily exertion, being kept too warm, errors of diet, persistent constipation, and the occurrence of certain complications. A "diminution of temperature" is brought on at this stage by hemorrhages, copious stools, vomitings, or perspirations; also by imperfect respiration, paralysis of the heart, pressure on the brain, and starvation. Occasionally by a deep sleep, external applications of cold, bloodletting; and the administration of medicines already recognized as antipyretic, calomel, antimony, lead, digitalis, veratrine, quinine, acids, and cooling salts: though the individual susceptibility to these agents differs greatly.

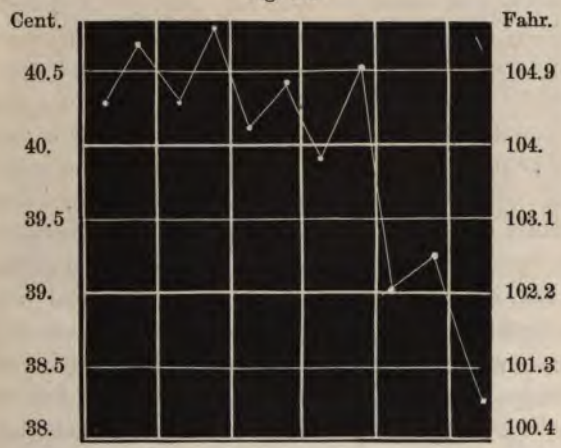
The course of temperature during "convalescence" differs as much as the modes of recovery. In one disease, the morbid process being exhausted, recovery takes place by a simple reaction; it is the course in typhus, varioloid, measles, lobar and uncomplicated pneumonia, febriculæ, relapsing fever, facial erysipelas, fever of the cholera reactions without parenchymatous degeneration of the kidneys. But in convalescence of other forms there is such alterations of texture, such organic destruction of old tissues, and so many new products standing in new organic relations, that in the midst of these conflicting elements convalescence becomes almost a secondary disease. So it acts in typhoid (enteric) fever, scarlatina, true small-pox, polyarticular rheumatism, all forms of meningitis, trichinosis, pleurisy, pericarditis, dysentery, etc. Complications, in the first class, may lead to the same difficult convalescence. In both classes the course of the temperature corresponds to these various relations, and judges the chances

of recovery. In cases of laborious convalescence considerable elevations of temperature intervene in the midst of the healing process; this harmonizes with the fact that the greatest dangers for patients often meet them in the period of recovery. On the other hand, where there is no great obstacle to recovery, the fever-heat passes away with the disease.

During convalescence the temperature passes through three periods: of decided, still insufficient decrease (*stadium decrementi*); of cessation of fever (which I have named, and is known as defervescence); and the terminal (epicritical) period of recovery.

The first stage cannot be observed in all cases; when present, it succeeds the fastigium or the amphibolic period;

Fig. 22.



then comes a slight fall, at once followed by unmistakable defervescence. (See Fig. 22.)

This process may be gone through so imperceptibly that it is difficult to mark the commencement of defervescence.

It may amount to .5° or 1° C. even to 3° C.=9°—1.8°—5.2° F.; it may consist in a moderation or absence of the regular evening exacerbation; or in a greater morning remission (with the ordinary exacerbation); or the morning remission is more, the evening exacerbation less marked, making the daily difference the same, though the average temperature of the day appear lower; or it may consist in a pseudo-crisis followed by a slight rise of temperature: so that the average temperature may be lower, and yet a slow fever persists for almost a week, till it is replaced by the true defervescence. This course is distinguished from the amphibolic stage by the absence of aggravations, by the normality of the rise of the evening temperature, and the regularity of the morning remissions.

This "stadium decrementi" may be met with in all sorts of diseases; defervescence may succeed it rapidly or lingeringly; therapeutics may hasten it. Otherwise, its length varies with the kind of disease, it is longest in typhoid fever and the suppurating stage of variola, shorter in petechial typhus and scarlatina, shorter still in measles and lobar pneumonia. In atypical diseases its length is variable. Such moderations of temperature are deceptive in pyæmia and the amphibolic stage of many diseases.

The "period of defervescence" proper is that which affords the safer indications as to anomalies and impediments to recovery. Defervescence may be complete in four, twelve, twenty-four, at most thirty-six hours, during which we witness a fall of 2°—5° C.=3.6°—9° F. and more, descending to normal or below it. (Figs. 23 and 24.)

The fever may terminate in that short time; yet its end must not be assumed till we see whether the next exacerbation rises to the height of the previous day; if it does not, the defervescence is confirmed. It may also happen

that the temperature rises a little on the second evening, but not considerably. (See Fig. 25.)

Fig. 23.

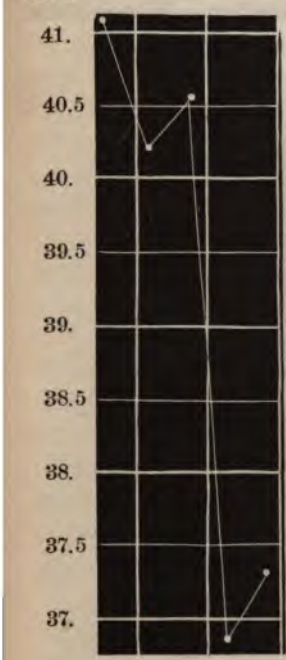
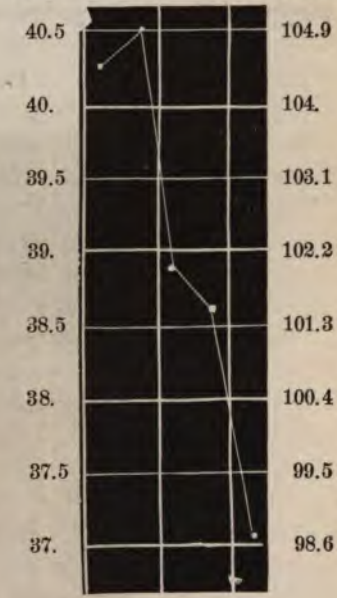


Fig. 24.

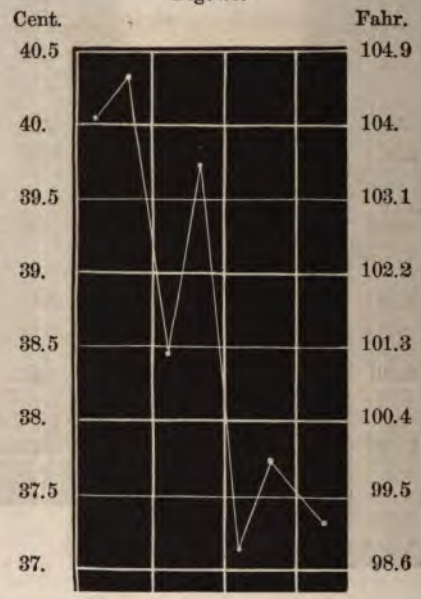


There may be no defervescence in the morning, only a moderate depression, even a heightening of temperature, followed by defervescence in the afternoon or evening, which instead of exacerbation marks a slight fall of $\frac{1}{10}°$—$\frac{3}{10}°$ C.$=\frac{1}{5}°$—$\frac{1}{2}°$ F. or a little more, which will serve as the basis to calculate upon the defervescence of the next evening. (See Fig. 26.)

The temperature often falls below the normal to 36° C.$=$ 96.8° F., or even lower, especially when hastened by de-

pressing remedies, and yet defervescence is assured only when the temperature of the next evening remains normal. After such rapid falls, collapse may follow, creating disturbance in the patient and anxiety around him. Thermometry enables us to judge of the position. The critical

Fig. 25.

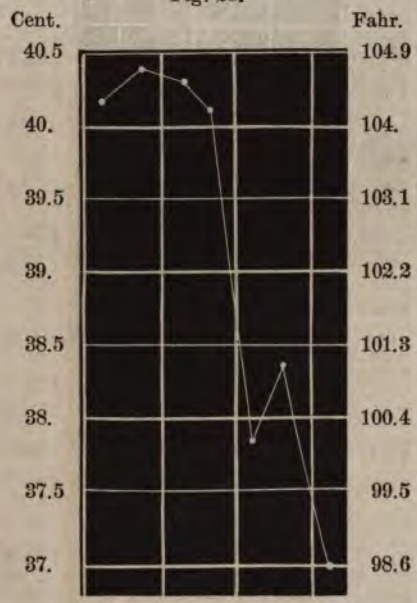


condition may last several hours or days, accompanied with delirium and other symptoms; yet, if the temperature continues normal or subnormal every thing is safe, but from the effects of extraneous events, like perforation. Relapsing fever presents the type of these rapid defervescences of 5°—6° C.=9°—10.8° F.: such excursus happens at the close of the first attack or of the relapse.

An opposite mode of "defervescence" takes place more

slowly on an "extended line" or "lysis." Temperature "continuous," falling tediously, less from morning to evening than from evening to morning, almost stationary; its decline occupies several days or a week (Fig. 27); so it is

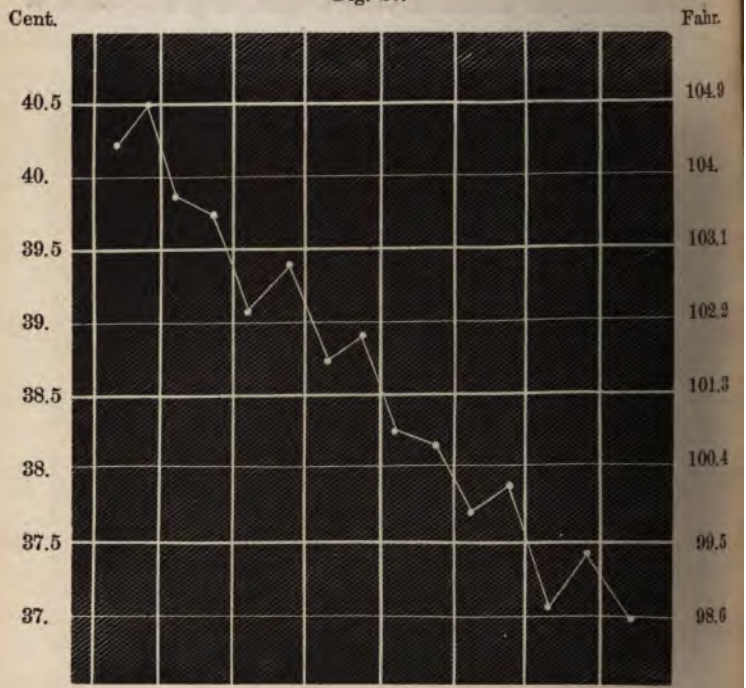
Fig. 26.



in scarlatina and typhus, sometimes in pneumonia, seldom in typhoid fever, etc. Or the "lysis" may affect a "remittent" type, in which morning remissions alternate with evening exacerbations; but on the whole, either the daily maximum or the daily average is less from day to day; this may last from three to seven days, even subject to interruptions. In this way evening exacerbations may continue high, and morning remissions become more marked, till the exacerbations decrease too. (Fig. 28.) Or,

the daily differences remaining the same, morning and evening temperature become lower (Fig. 29); or the

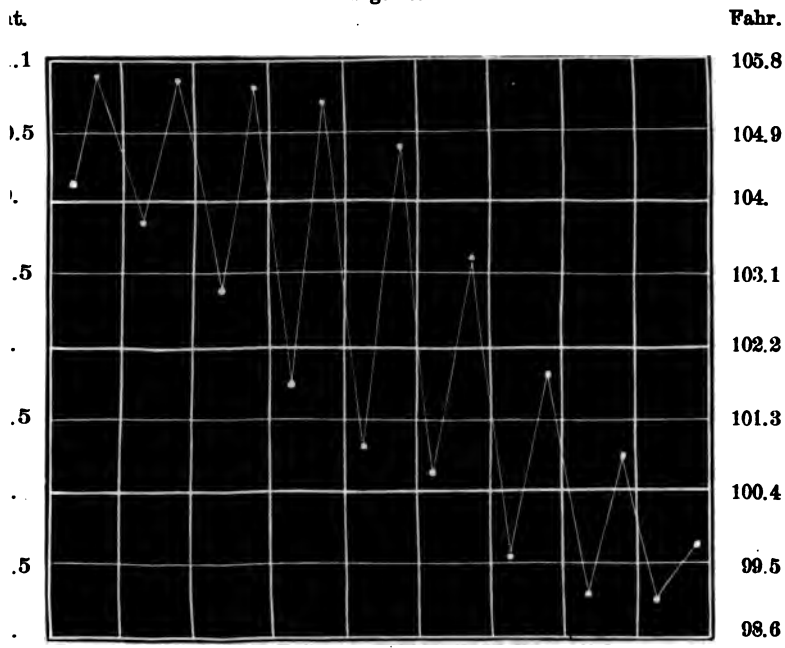
Fig. 27.



evening exacerbations gradually approximate the morning remission. (Fig. 30.) These various forms may succeed one another slowly or abruptly. "Remitting defervescence" characterizes typhoid fever, is met with in catarrhal diseases, trichinosis, peritonitis, pericarditis, and lasts about four days. Collapse frequently occurs in severe remitting defervescence, in consequence of the fall of the morning temperature being considerably below normal during several days.

In the "epicritical period," especially in "convalescence," the temperature is normal in the morning and evening, showing only the daily fluctuations; a guaranty that the healing process will follow. But as long as

Fig. 28.



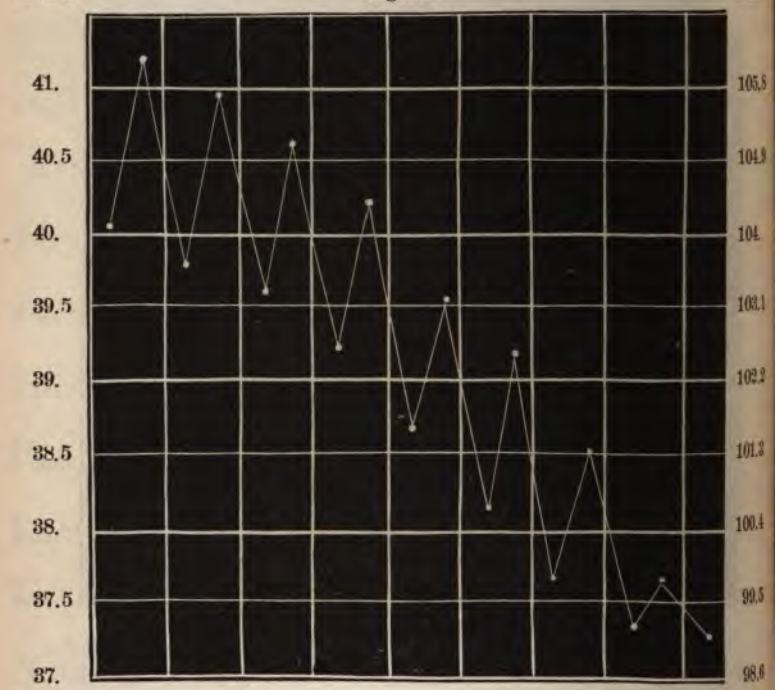
febrile temperatures are met with in the evening, convalescence is not perfect, and if in the morning, they are yet less promising. However, in several cases and diseases convalescence is arrived at through these febrile elevations, which may be caused by an indulgence in animal food, early walking, etc.

The beginning of an acute affection (whether relapse or complication) during convalescence is always attended

with a rise of temperature after the type of the new affection.

If an illness, instead of ending in cure or death, is followed by "sequelæ," the healing process is retarded or interrupted, and exhibits many deviations from the norme.

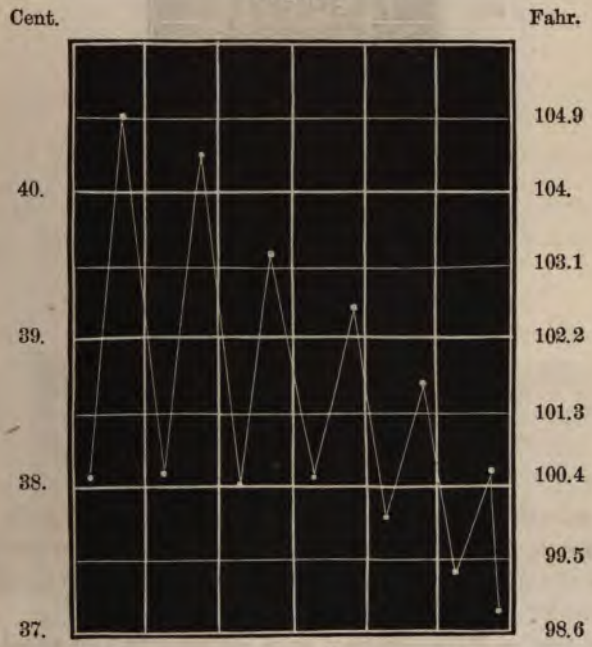
Fig. 29.



This passage from the primitive disease to its sequelæ may occur during the amphibolic stage, the decrement, or the defervescence; then the lysis is proved to be only apparent by a fresh elevation of temperature and the absence of farther progress, and the new course is determined by the nature of the sequelæ, not by that of the primary disease.

A "fatal termination" is preceded by symptoms long or short, threatening or promising. The "pro-agonistic period" is far from being simple, but thermometric observation throws a light on its "habits" and duration. By the light of temperature we see this stage assume various

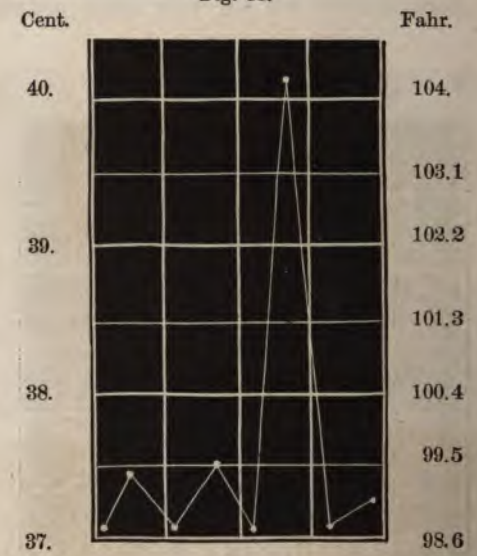
Fig. 30.



forms. The "ascending," whose commencement may be uncertain, if its character is uniform with that of the original disease, or if an amphibolic stage has preceded; but are sharply defined if the primary disease has entered into the period of convalescence, even in that of recovery, or when the pathological temperature has been reduced by therapeutics. It is also well marked when the previous

course was continuous, and especially when the pro-agonistic period begins with a rapid rise in the course of a disease previously apyretic. In this ascending form the

Fig. 31.

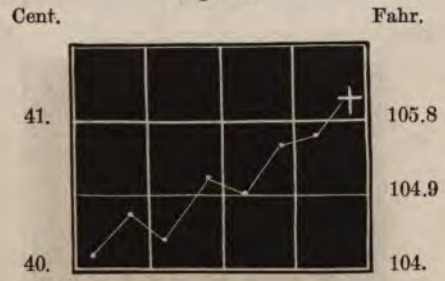


rise affects the form of a zigzag, slightly declining in the morning, rising higher at every evening exacerbation; thus the average height increases with the daily maxima (Fig. 32).

In this way temperature may continue to rise regularly through the pro-agonistic period, or it may succeed to an irregular course, or follow the fluctuations of the amphibolic stage; or begins to rise after a moderate or not truly febrile condition; or after some apparently favorable event; or after convalescence has made considerable progress; or it may set in after a fall of temperature to normal or below it, after a deceptive remission, or a short collapse.

In contradistinction to this "steady rise" of temperature, "rapid and extreme heights" may be reached

Fig. 32.



in the pro-agonistic period, succeeding to a high, moderate, or low previous temperature. In the first and most

Fig. 33.

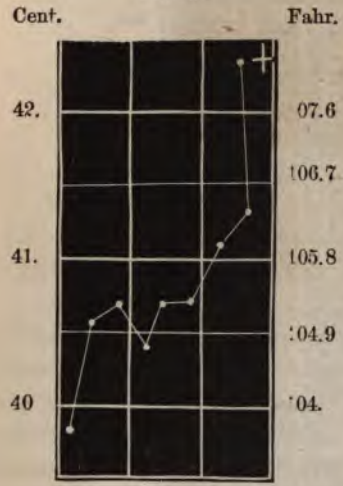
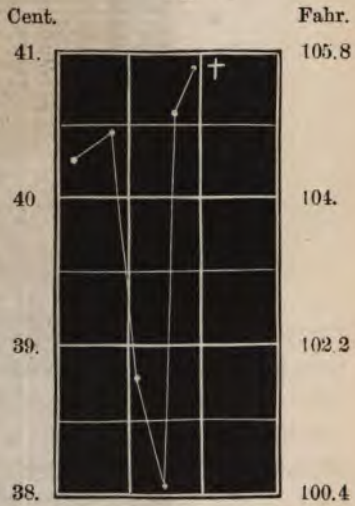


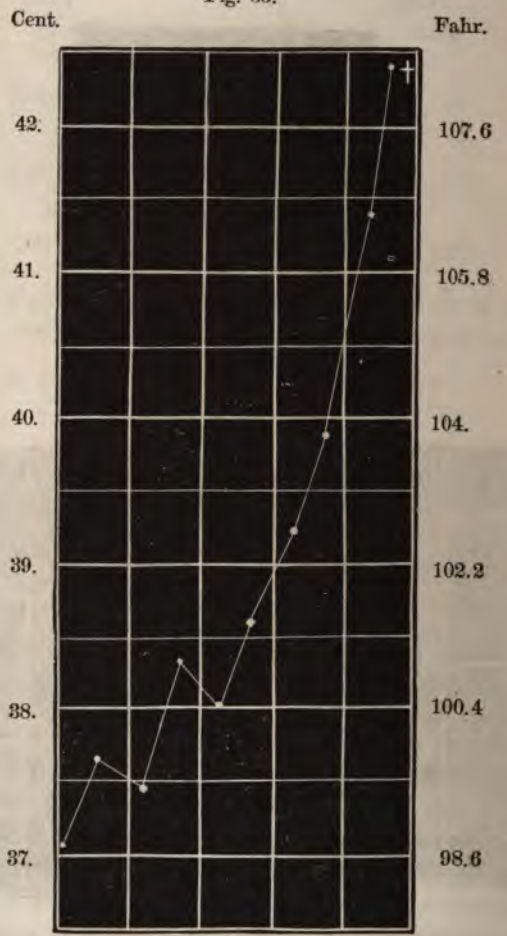
Fig. 34.



common case the previous temperature had reached 40°—41° C.=104°—105.8 F. or more, when a further rise of

one to two per cent., =1.8°—3.6° F. sets in. In this condition the pro-agonistic stage is short, and imperceptibly merges in the death-agony (Fig. 33).

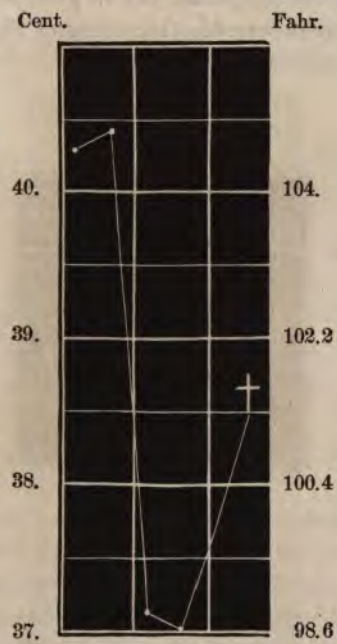
Fig. 35.



In the second case the final rise is often very con

siderable when compared with the preceding fall; yet the absolute height is not altogether remarkable *per se*. In these cases, too, the pro-agonistic period merges at once into the final agony (Fig. 34).

Fig. 36.

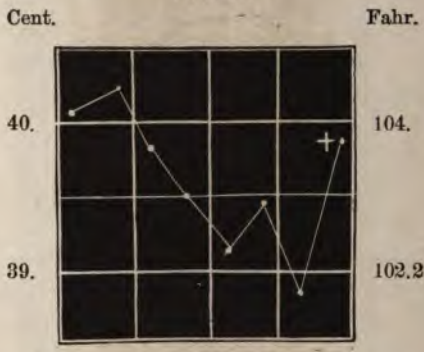


Lastly, in the third category, to which belong the hyperpyretic rises of temperature of fatal neuroses and of diseases of the brain free from fever, we may consider the whole period in which the temperature is rising as the pro-agonistic stage. It begins slow, becomes rapid, and attains enormous heights (Fig. 35).

Far more common than the ascending form of the pro-agonistic stage, is that with decrease of temperature, the

"descending type." And it is much more important to regard this form, inasmuch as a superficial and partial consideration of the temperature only, might lead us to consider its decrease as a sign of amendment. "*A careful attention to the state of the pulse is our best safeguard against this gross deception, for in such cases, along with the fall of temperature, the frequency of the pulse increases in the most striking manner.*"

Fig. 37.

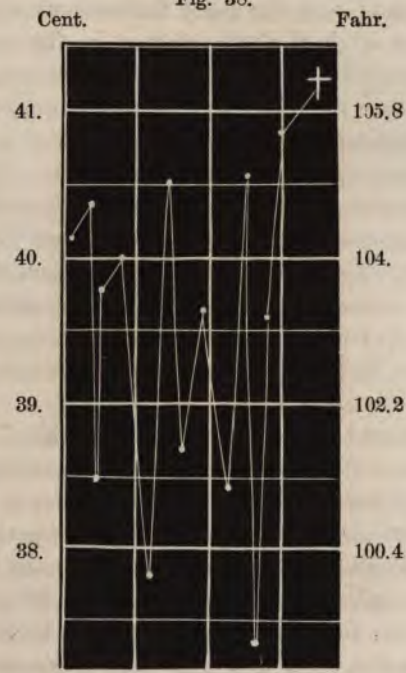


The pro-agonistic stage may be short in this "descending type;" twelve hours to two days for a decrease of 1° C=1.8° F., or till the normal is reached. After this pro-lethal moderation of temperature there is a sudden rise in the death-agony itself. (Fig. 36.)

In other cases the remissions are periodical, whilst interrupted by fresh exacerbations; there is irregularity by plunges, not the zigzag descent of lysis. This form occurs in the early complications of almost any disease, nervous affections, bad nursing, and dosing. At other times the rise and fall of temperature in the pre-agonistic stage is tolerably regular, beginning with a fall of half a day to two days and a half; rising again, even higher than its

starting point, ending in an exceptional rise or a fall. But in some-cases (most difficult to prognose), the temperature pursues a descending course, whilst all the other severe symptoms continue; the patient dies whilst the temperature sinks deeper or undergoes fatal perturbations, in which death takes place (Fig. 37); such is the course in

Fig. 38.



basilar meningitis, typhus and typhoid fevers, especially in scarlatina, rarely in pneumonia; indeed, some cases seem as if fated.

In rare cases the temperature is not modified in the pre-agonistic period, where an unfavorable prognosis must be founded on other data, as a continuous quickening of

the pulse independent of a stationary temperature. Lastly, the pre-agonistic stage may be marked by extraordinary fluctuations of temperature repeating themselves several times in a day; there are deep falls and high elevations, in either of which death comes. Pyæmic affections are of this type. (See Fig. 38.)

In the "death-agony" the course of temperature is very varied. It may keep the daily fluctuations without peculiarity rather high if death occurs in the exacerbation, and moderate if in the remission. In patients from fever the temperature rises ½ to 1° F. during the agony. If the fatal rise is moderate, there is a recession of a few tenths in the last hours, subject to two exceptions. In not a few cases, whether the previous temperatures have been febrile, normal, or subnormal, a "fall of temperature" occurs in the death-agony, which, when the preceding temperatures have been above normal, may be rapid and considerable; the patient dies in collapse. This happens in many consumptive diseases, inanition, hæmorrhages, cholera-flux, perforation of the intestines, etc.

On the other hand, an "extraordinary rise" of temperature occurs in the death-agony itself in patients who have shown a high febrile-warmth, and in those, as well, whose illness has exhibited no elevation of temperature. This rise in the death-agony happens in malignant febrile affections whose infectious character is probable, typhus and typhoid fever, in fatal cases of yellow fever, scarlatina, variola, pyæmia, septicæmia, and sunstroke, and less commonly in pneumonia, measles, endocarditis, fatty degeneration, malignant peritonitis, erysipelas and rheumatism, osteo-myelitis, and acute miliary tuberculosis. In these cases severe cerebral disturbance exists, but the main cause of the excessive disengagement of heat seems to be an extensive chemical process of a zymotic nature.

Moreover, there are diseases in which the affection of the nervous centres appears to determine the essential, or one of the essential disturbances: partly coarse anatomical changes; *e. g.*, meningitis of the convexity, softening of the brain, and the so-called central neuroses, tetanus, epilepsy, hysteria, &c., in which the temperature begins to rise for the first time in the last days of life, and very rapidly reaches enormous heights. In these cases, is the fatal rise an effect or the cause of the death-agony and termination? *Senator*, in Virchow's *Archiv.*, xiv. 412, thinks the latter is true, agony and death occurring because (from some cause or other) the temperature rises to a height incompatible with life. The matter scarcely seems so simple, though no other cause could be more effective than an enormous elevation of temperature.

The "moment of death" is not indicated by any special alteration of temperature; a moderate, even low pre-agonistic temperature sinks most in the few last moments of life. When the temperature is high during agony, it often reaches at death-time a height it never attained before; or it simply falls to minimal diminution from the previous height.

"After death," in the majority of cases, the temperature begins to fall. The decrease is more sudden when the patient dies with a low than with a high temperature. The rapidity of cooling, at first slow, increases as it goes on.

In many cases a small rise, seldom amounting to more than a few tenths of a degree, may be observed after death, and continues from a few minutes to an hour; then a short pause ensues, followed by a tedious sinking of temperature, which after a time becomes more rapid. This "*post-mortem* rise" occurs sometimes in cholera, and in cases terminating in hyperpyretic temperatures, either

when the rise continued to the moment of death, or left room for a short pro-lethal decrease. This phenomenon is based on two causes: The occurrence of death puts an end to the process of cooling by inspiration of cold air and by perspiration; and new sources of warmth are opened by changes in the substance of the muscles and *post-mortem* decomposition, two sources foreign to the living body, sufficient to more than compensate for the loss of heat from those of its sources extinct with life.

In cerebro-spinal meningitis, temperatures of 104°—111° F. have been observed just after death. Simon observed 104°—113° after death from variola. Assistant Surgeon F. M. Mackenzie observed 106°.2° F. in the rectum after death from cholera. (*London Hospital Reports*, vol. iii., p. 454. Note by Dr. W. B. Woodman.)

Table of Temperature taken in the Dead House of Guy's Hospital, probably after the Bodies had been Washed, by placing the Ball of the Thermometer on the Abodomen. From Dr. Taylor's Principle and Practice of Medical Jurisprudence, p. 6:

	First period 2 to 3 hours after death.		Second period 4 to 6 hours after death.		Third period 6 to 8 hours after death.		Fourth period 12 hours after death.	
No. of observations...	76		49		29		35	
	F.	C.	F.	C.	F.	C.	F.	C.
Maximum temperature of the body...	92°	34.4°	86°	30°	80°	26.6°	79°	26.1°
Minimum temperature of the body...	60°	15.5°	62°	16.6°	60°	15.5°	56°	13.3°
Averages temperature of the body.....	77°	25°	74°	23.3°	70°	21.1°	67°	19.4°

CHAPTER XII.

ON THE TEMPERATURE IN SPECIAL DISEASES.

A COMPLETE insight into the course of the temperature in disease can only be obtained by comparison of the curves of many separate cases. It is only thus that the mind awakens to the conviction of their harmony, and gains the faculty of finding itself at home in the manifold modifications and deviations of the temperature of the sick.

The rules deduced from the "comparison of separate cases," though derived from one's own large experience, are never complete, and like empirical abstractions fail to bear the "stamp of inevitability:" fresh experience may modify or overthrow them.

To deduce the rules from "quantitative" materials would lead to delusive results. The true characteristics are not to be sought in the absolute height of the temperature of a given day, but in the orderly succession of the temperature in the whole course of the disease, or during a definite portion of it; in the rise to a certain height, and fall to a certain depth, at regular, occasional, or fortuitous times. A more statistical estimation of the curves obliterates the peculiarities of the course of the temperature, and a more numerical treatment of the mass of cases can only give a trustworthy answer to certain limited questions.

Therefore we must look less to the "numbers" and more to the "form," or varied outlines of the wave-system. Their comparison enables us to construct a sort of model-

curve or standard measure of single cases. I am aware that the general rules, of which the wave-system is, so to speak, the image, can never attain to the concrete actualities of a particular case; but I have so constant proof—in the copious stores of material at my command—of the correctness of the principle these rules are founded upon, that I hope they do not caricature or contradict nature, but will be of service to those interested in medical thermometry.

In this "method of representation," the types of diseases, and their principal varieties, are the only details to be admitted. In this course there is danger, I know, of considering "mere abstractions" as "special forms" of disease; of comprehending under the same name things which differ. and rudely separating others closely related; but there is no great danger that these abstractions will be misunderstood by those who use them as standard categories.

The typical course of the temperature in many forms of disease is no mere speculation, but an acknowledgment of undeniable facts. It is only doubtful or optional how many diseases should be included in such a classification.

Once the typical theory admitted, we are confronted with the idea that there are such things as "normal diseases." The distinction (between normal and abnormal) was first introduced by *Rilliet* and *Barthez*, in their incomparable "Treatise on the Diseases of Children." For them, the "normal course" of a disease is such "as represents the uncomplicated results of a specific primary cause in a previously healthy individual." Above all other phenomena, the course of the temperature permits us to distinguish "what is normal and characteristic in the course of diseases, from what is abnormal in individual cases." The fact that the "abnormal cases" may practically outnumber the

"normal ones," will not invalidate the value of the type for any mind familiar with the proportions of exceptions to law in other physical sciences. It is only necessary to remember that in different forms of disease the limits of the normal are sometimes boldly, sometimes faintly defined, and at other times merge obscurely into others; and that, though we recognize the "principle," we cannot force all forms of diseases to conform to a given type.

I. Typhoid Fever.—(Syn. *Enteric Fever, Dothinenteritis.*)

Typhoid fever pursues its course with unmistakable regularity, and next to the relapsing and intermittent, affords the best proof of the theory of types. However the course of particular cases may dissemble, yet it is impossible not to recognize, amidst their differences, the marvellous regularity of its course, the foundation of its type. And more: in this pre-eminently typical disease, there is not a single rule which is not subject to exceptions; deviations may occur in any segment of its course, but they are neither so numerous nor so important as to obliterate the type.

But there are cases whose diagnosis remains doubtful, till recovery or death takes place, between typhoid fever and acute tuberculosis, basilar meningitis, epidemic cerebro-spinal meningitis, typhus, pyæmia, etc., and also localized diseases, like myocarditis, endocarditis with ulceration of the valves, abscess of the liver, etc., all of which closely simulate the march of typhoid fever. Still more difficult is it to be sure whether the typhoid affection has not supervened upon some other. Thermometry cannot always solve these doubts;

but it can decide some otherwise obscure points of diagnosis, such as certifying that the apparently typhoid is another affection, or that the typhoid really complicates the other affection; and it gives us the means and power of answering questions relative to the disease, and a standard for judging of the propriety of the answers.

To gain the full practical value of thermometry in typhoid fever, attention must be paid to the following points: A single observation, *per se*, is never sufficient; made at a certain time, however, it may contraindicate the typhoidal character. It demonstrates its improbability or impossibility when it shows a temperature of 40° C.= 104° F. the first day or the second morning; when between the fourth and sixth day the temperature in a child or adult under middle age never reaches 39.5° C.= 103.1° F., and indeed if it has failed to do so two or three times; when as early as the second half of the first week considerable or progressive diminutions of the evening temperature are met with.

Contrarily, thermometric observations alone raise the suspicion or support the conjecture that typhoid fever is latent: in slight cases, when the course of the temperature does not depend on a local affection, the object of the complaint of a patient; in the first week or first four days of the disease, when the disease attacks one previously ill or convalescent. To decide upon the presence of typhoid fever, morning and evening temperatures for three days in the beginning, four to six in the fastigium, or as much in the convalescence, are necessary.

The temperature indicates the "severity" of the disease about the middle of the second week, rarely earlier. A single observation does not do it, a whole day's observation gives it; but two or three days are still better. It indicates, best of all signs, the "irregularities" in the course;

the "complications" that no other means can detect; a "relapse" after the patient has begun to recover; warns of the "tendency" towards death; "regulates the potency" of therapeutic operations; shows the "tendency to convalescence" with great definiteness, etc.; besides the most important fact that a large thermometric experience in typhoid fever has rendered possible the knowledge of its course and the certainty of its diagnosis and prognosis, which were absolutely impossible with the previous means of observation.

"The typhoid fever is characterized by a fever which lasts for at least three weeks" (excepting extraordinary cases and those of rapid death, seldom lasting less than a week). The maximum temperature is seldom less than 39.6° C.=103.28° F.; more commonly 40°—41° C.=104°—105.8° F.; when hyperpyretic, rarely above 43.5° C.=110.3° F. Fatal above 41.5° C.=106.7° F.

The "daily course" is according to the intensity and the period of the disease. Either continuous with highly febrile elevations in very severe cases; or subcontinuous or continuous without great intercurrent elevations at any time in severe cases. It is remittent at the beginning of all cases moderately severe or slight; often at the height of the severe cases, and always at the beginning of convalescence. Altogether, the type of the typhoid fever is remittent (with sharp curves) during the period of recovery. Its course may repeat itself irregularly in many of the severe cases, at critical periods, or by the operation of circumstances.

Accordingly the "daily average" on which the "daily fluctuations" are based, varies a good deal; in the "continuous form" with exacerbations it is 40.5° C.=104.9° F. or more; in the "subcontinuous" and continuous 40° C.= 104° F. or a few tenths more or less; in the "milder re-

mittent" about 39.5° C.=103.1° F.; in "slight cases" as low as 39.2° C.=102.56° F.; at the commencement of and in the convalescence still lower, in the former with sharp curves, 38°—38.5° C.=100.4°—101.3° F.

When the fluctuations are irregular, the daily average is uncertain, and affords no indications.

The daily "maxima" are included between noon and 11 P.M.; commonly between 4 and 7 P.M.

The "extent of the exacerbations" at the height of severe cases is very large; the rise begins between 7 and 9 A.M.; the curve is single-peaked with a broad summit (rarely two, three, four-peaked). From the third week on, the latter peaks prevail, and the single ones are more acute in the convalescence, thus narrowing the extent of the exacerbation.

The "rise of the multiple peaks" occur: the first between 9 A.M. and 4 P.M.; the second between 2 and 8 P.M. (often at 6); the night-rise is between 1 and 5 A.M. sometimes double, first at 11 P.M., second as above. The second of a double-peaked summit is the higher in the period of increase. The "lowest point of the remission" occurs between midnight and 10 A.M., oftener at 6, 8, and 9 A.M.; it is not very low, is very acute, lasts only a few minutes in recent and in severe cases, but increases in breadth with the progress of convalescence.

The "rise of temperature" is either gradual or sudden, a segment of it may be tardy, the remainder rapid. The "daily descent" is slow, effecting the form of an easel, rapid only when there are irregularities.

Typhoid fever has "two principal types" which agree at their "beginning" and "end," but not in their middle course. This distinction is justified also by anatomical differences. One lasts but three weeks, and presents only slight infiltrations of the plexus of intestinal glands (plaques

molles); the other lasts from four to six, sometimes nine or ten weeks, and presents extensive and successive deposits. In the former, the cure takes place easily, by restorative, retrograde metamorphosis; the latter, on the contrary, needs a complicated process of elimination, to dislodge the deposits. Ulcers follow this dislodgment, whose healing is protracted. This complicated process of restoration affords numerous opportunities for ulcerous extensions, intercurrent febrile attacks, complications, and accidents.

There are cases corresponding almost to these typical descriptions, but the majority occupy a middle ground, approaching nearer one or the other type, anatomically as well as pathologically. Exceptionally, the difference between the two types is marked from the beginning. The duration of the two varies in different places, and in the same place at different times. The mortality depends chiefly upon the "preponderance in numbers of one or the other type:" all conclusions as to the results of therapeutics must be subordinate to these rules.

After the consideration of the types comes that of the "individual circumstances, irregularities, and deviations from the normal course of the fever," whose influence is almost null on the first type, but great during the second. "A relapse" entering, just when the fever of the first attack leaves the patient, presents the most typical course of typhoid fever. The "regular course of typhoid fever" is met with in healthy persons, æt. 18 to 20, other circumstances being favorable. On the other hand, in children (the younger the worse), in people above 35 or 40, or sick of some other disease, in puerperal and scarlatina cases, and particularly in endo- and pericarditis, pleurisy, phthisis, hysteria, and parenchymatous nephritis, the typhoidal type is more obliterated.

The course of the typhoid fever is rendered irregular by simultaneous epidemics, by being very slight, or very severe, or extremely short, by injurious influences before or at the beginning of the attack, defects of nursing, mistakes in the treatment, undue muscular exertions, severe hæmorrhages, perforations of the bowels, complications of overwhelming severity.

On the other hand, a skilful treatment will often favorably modify the type.

At the approach of death the characters of the normal course disappear.

Yet, through these deviations and irregularities some indications of the reign of law are perceptible. In both regular and irregular cases, the typhoid fevers may be divided into "two well-marked periods," which are distinguished by the thermometer with great certainty. The first corresponds to the "deposition and infiltration" (in the intestinal glands); the second to its "elimination," and to the "restoration" and "repair" of the diseased parts. Both stages are marked by points at which an alteration of the fever occurs, not sensible to anatomic, but to thermometric investigation.

It is noteworthy that in the majority of cases which run a regular course, the duration of the separate periods corresponds in time with the division into weeks and half-weeks. The alterations in the course, and the transitions from one stage to another, occur at the beginning or end of a week, or in the very middle. This type is most decidedly shown in the brief and mild forms, and in the third or fourth week of the more severe ones (in the relapses).

Setting aside a period of "incubation" whose symptoms —disorders of the bowels, headache, febricula, and rigor— escape the observation, the "initial stage" of abdominal

typhus runs its course with great regularity, whatever complexion the case may afterwards assume. During three or four days the temperature always takes the ascending course, rising about 1°—1½° C.=1.8—2.7 F., from every morning till evening; and falls from every evening till the next morning about ½°—¾° C.=.9°—1.3° F., till on the third or fourth evening a temperature of 40° C.=104° F. is reached, or a little exceeded. The formula of this ascent is nearly as follows:—

First day, morning, 37° C.=98.6° F.; evening, 38.5° C.=101.8° F.
Second day, morning, 37.9° C.=100.21° F.; evening, 39.2° C.=102.56° F.
Third day, morning, 38.7° C.=101.66° F.; evening, 39.8° C.=103.64° F.
Fourth day, morning, 39.2° C.=102.56° F.; evening, 40.3° C.=104.54° F.

The initial stage of typhoid fever very closely approximates this type; very seldom does any other disease show a similar pyrogenic course, which is of itself a decisive test for diagnosis. In other words, if the temperature of the second, third, and fourth evenings is only approximatively normal; if the temperature of the first three evenings, or of two of them, is of the same height; if the temperature of two out of the first three mornings is alike; if the temperature of the first two days rises to 40° C.=104° F. or more; if the temperature retrogrades only once on any of the first four mornings and evenings; in every one of these cases we may or must exclude typhoid fever from our diagnosis; and contrarily, said diagnosis is the more certain as the course of the temperature of the first four days comes nearer to the above formula.

Meanwhile, exceptions must not be overlooked. The rise may be completed in two days, or protracted five; both foreboding a severe course, the latter a delay in the favorable turn (crisis or lysis) till the middle of the third week; the temperature may return to normal the second morning,

and be succeeded by a greater rise the second evening; the rise of the first and second day being less, that of the third and fourth will be much more; the height reached the third and fourth day is not always 40° C.=104° F., but may be a few tenths less, or more by a whole degree, 41° C.=105.8° F.; when the typhoid fever is secondary to another disease its initial is obscure, often unrecognizable.

This first period decides nothing as to subsequent mildness or severity, and in the majority of cases escapes observation, because medical advice is sought for ordinarily later.

"In the second half of the first week, and the first half of the second," the course of the temperature is quite uniform, but cannot help the diagnosis. At this time the "maximal height," 40°—41.5° C.=104°—106.7° F., is reached rarely more than once between noon and evening of the fourth or fifth day; meantime the morning temperature is ½°—1½° C.=.9—2.7° F. lower than the evening's; one remission may be accidentally even lower.

During the second half of the first week the daily maxima remain close to the maximum; the first half of the second week, though agreeing in the main with the former, shows a trifle lighter exacerbations when the cases will turn favorably, and the remissions become somewhat deeper; so that the fastigium divides itself into two segments, the first with more severe exacerbations and less average remissions, the second with more moderate exacerbations and more considerable remissions.

The "first stage of the fastigium" ends the seventh or eighth day (really from the sixth to the tenth). During it, one temporary diminution of temperature may occur, once in a morning and once in an evening, generally before the tenth day. This period may be mild or severe; nothing can be predicted from it with certainty.

Cases will occur with "an unusually mild course" of four to eleven days, with evening temperature at 39.6°—39.8° C.=103.28°—103.64° F., possibly with intercurrent moderations; and morning remissions as low as 1½°—2° C.=2.7°—3.6° F.; or the course appears to be cut short.

Early convalescences may be due to the mildness of the affection, to a judicious treatment, even to an opportune laxative; other cases occupy the normal time (three weeks), though all the symptoms are mild; and in others the fever recurs in consequence of new deposits, and runs new periods. We regard this as the probable course of the disease, though in the early recoveries, in the absence of *post-mortems*, the typhoidal character remains doubtful; and in regard to the protracted recoveries, we are not *certain* that the course of the typhoid fever *must* have a fixed duration, or *cannot* occur without certain symptoms reckoned as pathognomonic. But we can say that, in our time and our country, it is rare for a case of well-characterized typhoid fever to last less than two weeks and a half (unless by the agency of therapeutics); and even for a mild case to show a decided defervescence before the twenty-first day.

Meanwhile, it is quite possible that under these denominations, "abdominal typhus, enteric, or typhoid fever, etc.," may be included two essentially different diseases, though both located in the glandular apparatus of the bowels: one, a general disease the product of infection, the other a local enteritis in which the follicular apparatus alone is affected. What happens in scarlatina supports this hypothesis, in cholera also, where the epidemic induced by contagion is perfectly simulated by the simple cholera morbus. This obscure condition thermometry cannot clear up, but it adds the strongest light to the evi[illegible]ology, of circumstances, and of the remain-

ing symptoms. For instance, if the temperature several evenings reaches the range of typhoid fever, without particular reason or bad nursing, the presumption is that it is typhoid. Even if the temperature is like it for a septenary, or only a little below, all other symptoms comformable, æt. above 30, or an anæmic child, the presumption is still for typhoid fever.

However "characteristic" may be the fastigium, its information is no sure guide to those who have not had the opportunity of studying the initial period, and typhoid fever may then be mistaken for pneumonia, and *vice versâ*, especially where hepatization takes place slowly; acute exanthems, typhus by the temperature in the fastigium (though ordinarily higher in this), cerebro-spinal meningitis, acute osteo-myelitis (which has same fever course, but with local phenomena), acute tuberculosis, trichinosis (which has the same course of temperature), abscess of the liver and pyæmia (similar symptoms), intestinal catarrh (which has a lower range of temperature if the nursing is proper), influenza, under the same conditions as the catarrh.

Although thermometry does not always, but often, succeed in mastering these difficulties of the fastigium period, it permits us to exclude typhoid fever from the diagnosis in young adults when the evening temperature keeps under 39.6° C.=103.28 F., and in all cases when, during the severity of other symptoms, the temperature sinks to normal. It confirms a typhoid prognosis in illness of moderate severity during the fastigium, when "previously healthy persons of youthful or middle age," after being ill five days or a week, "exhibit evening temperatures of 39.7°—40.5° C.=103.46°—104.9° F., or a little higher, alternating with morning temperatures lower by $\frac{3}{4}$°—$1\frac{1}{2}$° C.=135°—207° F." (grave complications or gross neglect excepted).

If the fastigium mark 41° C.=105.8° F. or more, or there is no remission, it is owing either to the severity of the case, to the want of proper care, to manifold mistakes, or to complications (rare at this period). Though extravagant temperatures are rather against than in favor of typhoid fever, thermometric observations conducted for a few days may decide the affirmative.

In the "middle of the second week," between the ninth and twelfth days, slight and severe cases show a well-defined difference.

In slight cases the fastigium is shortened, with or without a brief perturbation; the favorable crisis (on the tenth or twelfth day) shows the first decided morning remission; the second may be less marked, but those following increase at the same time that the exacerbations decrease in severity; the daily ascent begins later, the corresponding fall begins earlier; a decidedly descending direction is taken by the temperature, and the twenty-first day, if not sooner, the decrease of evening exacerbations shows the convalescence established.

When the conversion of the short daily curves of the fastigium into the slanting ones of convalescence happens during the second week, it is a sign of the mildness of the case, but no pledge against unforeseen dangers; it promises only that their sequel, less severe, may be averted by vigilance.

Less trustworthy is a considerable and early decrease of the evening exacerbations, so that they approximate the unlowered morning remissions; this is fraught with irregularities and fresh elevations of temperature.

The surest course towards convalescence is "increased morning remissions, succeeded by milder evening exacerbations," so that in six to ten days the temperature approaches to normal, through a descending zigzag progres-

sion. The difference between morning and evening temperatures may thus remain the same, or increase by the greater fall of the remissions; but the daily differences become less through the steady fall of exacerbations, till at the end of the third week normal temperature and convalescence meet.

This regular course leaves no doubt as to the diagnosis. Catarrhal pneumonia and influenza recover similarly but quicker, without fever during the third week; cerebro-spinal meningitis and trichinosis, with high temperature and in remittent form, are more protracted and more commonly interrupted; and other affections whose recovering affects this remitting form, have not so high a fastigium.

Other varieties of defervescence (than the remittent) are less common "during the third week." Apparent deviations from these types are due to erroneous chronologic statements.

With this course of temperature "complications" are rare, unless induced by "epidemic constitutions." On the contrary, "recrudescences" and "relapses" are frequent, particularly in mild forms. "Recrudescences" are initiated by a rise of the temperature or by an interruption in the descending course, rendering remissions imperfect and hastening exacerbations. On the contrary, "relapses" begin after the fever has left the patient, even during convalescence; they have a regular, and generally favorable course of twenty-one days, as said before.

A "severe course of disease" is predicted by persistent morning temperatures above 39.5° C.=103.1° F., and evening ones above 40.5° C.=104.9° F.; by the punctuality of the daily exacerbations, and by their prolongation beyond midnight, whilst the daily differences are slight, rendering the course subcontinuous, and when the minimum daily exceeds 39.6° C.=103.28° F. (lowest limit of typhus ex-

acerbations); or when the temperature does not moderate sooner than the twelfth day.

"All irregularities in the second week are suspicious," particularly no increase of the remissions, with almost stand-still exacerbations, even if the morning temperatures are higher than the evening. 40° C.=104° F. in the morning, and 41° C.=105.8° F. in the evening, during the second week, with a tendency to a rise, is a sign of a severe course; and worse of all are apparently purposeless fluctuations, among which are sudden decreases of temperature foreign to the course of typhoid fever.

In severe cases, "a complicated course" is particularly expected. The least dangerous is that in which (everything else being moderate) the evening exacerbation stands over 40° C.=104° F., and once above 41° C.=105.8° F., with morning remissions of at least 1° to 1½° C.=1.8°—2.7° F.: the course going on till or to the end of the third week prior to any improvement.

Sometimes the moderation comes in this way: the high temperatures of the second week do not recur, falling about ½ C.=$\frac{9}{10}$ F., with high fever and inconsiderable remissions; considerable remissions may be postponed to the fourth week, even in pretty favorable cases. Or the temperature may remain as high as in the second week or rise higher, during the third and fourth. The remissions are less than in the initial period, the exacerbations higher, even exorbitant; the former at 39.5°—40°, even 40.5° C.= 103.1°—104°—104.9° F., the latter to 41°—42° C.=105.8° 107.6° F., the mean daily being 40° C.=104° F.; the remission lasts one or two hours, and the exacerbation, thus extended, begins at 8 or 9 A.M., continues till midnight or even later, commonly describing two or more peaks.

Or, one irregularity may bring on another, resulting from the severity of the case, bad surroundings, idiosyn-

crasies, epidemic prevalences of an inflammatory character, like pneumonia. "Asiatic cholera" depresses even thirty-six hours before its collapse, and twenty-four before its characteristic diarrhœa commences: being here a premonitory symptom. Intercurrent hæmorrhages, too, depress the temperature even below normal, but it soon rises again. The momentary elevation of temperature in the former cases, and the momentary fall in the latter, are not the sole effects of the complications; they, also, destroy the typhoidal type, and prove injurious even after they have been happily overcome.

Extraordinarily, considerable fall of temperature occurs without known cause, without collapse, but with weakness of the cardiac contractions, enormous frequency of the pulse, delirium, automatic muscular movements, coma or extreme prostration, resembling the fall of temperature of the pro-agonistic period. These falls presenting great danger, yet not always fatal, we call "pro-lethoid" or "pro-agoniform."

Unless death succeeds, all severe cases have this in common: the fastigium and the whole course are protracted; at tolerably well-fixed days a moderation, at others an elevation of temperature happens. The remissions seem to prefer the last days or the middle one of a week; the rises come immediately *before* those days or at the beginning of a fresh week. The commonest event is a striking rise of at least $\frac{1}{2}$° C.=$\frac{9}{10}$° F. or more, about the twenty-fifth day, happening in the middle of a well-settled remission.

At this stage the diagnosis is seldom doubtful, unless tuberculosis or cerebro-spinal meningitis be suspected (if the latter is epidemic, for instance). Altogether, every case so protracted and complicated is threatening. A height of 41.2° C.=106.16° F. leaves little hope but

through a tedious protraction; at 41.4° C.=106.52° F. we see one cure out of three; at 41.5° C.=107.15° F., recovery is a rarity. Fiedler had two recoveries at 41.15° C., all the others and higher ending fatally. I had a rerecovery at 42.$\frac{1}{8}$° C.=33.7° R.=107.825° F. during a rigor. A repeated rise to a considerable height, say 41° C.=105.8° F., increases the danger considerably. Yet these are better borne if the morning or intercurrent temperature is low, high temperature with remissions being less dangerous than an almost continuous height. If the morning temperature exceeds 41° C.=105.8° F., death is almost certain. If the temperature is higher in the third than in the second week, let us take notice. All gross irregularities afford a bad prognosis or threaten further complications.

Severe cases rarely terminate by "favorable crisis;" oftener the "amphibolic stage" intervenes. This stage may intrude in cases previously slight; in aged persons, after previous ill-health, in recrudescence or relapse, after an irregular early stage, in patients exposed to injurious influences, having made great muscular exertions, etc. It commences in the third, sometimes in the fourth week, ordinarily preceded by an extensive remission, even by collapse, and exhibiting its apparently purposeless improvements and lapses. Its evening temperature is high, less so, however, than that of the fastigium; if not at one particular day, at least on the average. Intercurrently there are remissions, extensive but not steady, since favorable symptoms are followed by relapses; the falling of the temperature may degenerate into collapse, followed through great apparent danger by striking rises of temperature. Sometimes exacerbations of a stationary height alternate with deep remissions to or below the normal point, followed by collapse.

Although "defervescence" may establish itself through these abnormal alternations of a week or so, it is more common to see other "abnormalities" succeed these, viz., deep fall of temperature, or even collapse at the time appointed for exacerbation; transfer of exacerbations to the time of the remissions, and *vice versâ*, with no apparent cause, object, or danger; "complications" which raise the temperature and mask the remissions; and sudden great "fall" of temperature with hæmorrhage or perforation after a recrudescence of the course and a renewal of the symptoms. "Rigors" also set in with great rise of temperature, indicating pyæmia or septicæmia. This stage (amphibolic) lasts from three days to almost two weeks.

If the disease is tending towards death, the "pro-agonistic" stage often commences with deceptive and irregular depressions of temperature, quite discordant with the remaining symptoms. In other cases the temperature rises steadily, particularly in the morning, to 41° C.= 105.8° F., followed by sudden elevations up to 42.5°—43° C.=108.5°—109.4° F., or above. Or a sudden deep fall is accompanied with extreme collapse.

The "death-agony" is not always preceded by a distinct pre-agonistic stage; death may be as sudden as unexpected. In the death-agony and in the actual moment of death the temperature may be very low, highly febrile, or even hyperpyretic. If the temperature rises in the death-agony, it is with an increased rapidity at the approach of death amounting to ½° C.=2.7° F. in a single hour. Death generally happens between 42°—43° C.= 107.6°—109.4° F. *Post-mortem* elevations are met with, but last only a few minutes.

When severe cases tend towards "recovery," this often occurs after a critical perturbation, lasting from a few hours to a few days. Oftener, a moderation of temperature pre-

pares the ill-defined commencements of recovery. This "preparatory moderation" shows itself either in a single remission somewhat deeper than others, or in a slighter exacerbation, or in a temperature slightly descending for several days; the type remaining subcontinuous, with a daily mean of about 40° C. = 104° F.; lasting a whole week before any improvement appears. The "amendment" is generally announced by a great fall of temperature during remission time, even somewhat lower than will be that of the next day.

The beginning of "decided improvement," in cases of moderate severity, often occurs about the middle of the third week, in severe cases at its end, in the middle of the fourth, or even later. "Defervescence" occurs after the remittent type, as in lenient cases, only it may last longer. It may be so excessive as to cause more than one collapse, or it may induce a stand-still, even a slight relapse. Sometimes its even course is broken by single moderate or colossal fluctuations, by a solitary large rise, by several such, between which the temperature of the morning is found normal; or it is interrupted by a subcontinuous elevation of temperature lasting several days. Actual relapses are often witnessed during the defervescence.

Sometimes instead of showing a clear tendency toward death or recovery, the amphibolic stage elongates itself in a "lentescic process" (from *lentesco*, cleave, etc.), due to continuous ulceration of the bowels, or suppurative bronchitis, or tardy local affections, or to marasmus. The course of the fever, then, is chronic, with evening exacerbations and morning remissions which may reach the normal: duration illimited.

Complete "recovery" is admitted on the testimony of the temperature showing absence of fevers in at least two successive evenings; the thermometer is the final judge of

recovery. However, during "convalescence" the temperature often falls somewhat lower, say 36°—36.5° C.= 96.8°—97.7° F. in the morning, and under 37° C.= 98.6° F. in the evening—a good rather than a bad omen. But very often this "period of recovery" is complicated. The least significant disturbance consists in a brief, though quite considerable elevation of temperature, caused by the first indulgence of animal or other food, or by some moral impression.

In grave more than in slight cases of typhoid fever, febrile movements of one to three days will interfere with the march of recovery (simply retarding it). Thermometry tests these, and besides, the action of epidemics in protracting the disease. Frequently "true relapses," or repetitions of the typhoid process, occur during convalescence, and can be recognized only by the temperature of the first few days (no other symptom being then pathognomonic). These relapses are to be dreaded if elevations of temperature above normal occur eight days or more after the beginning of convalescence; though with timely care they are not dangerous, and offer the most perfect example of a simple, favorable, and quickly recovering typhoid process.

Various hypostrophes (ὑποστροφή, return, relapse) may occur here, that a fresh rise of temperature only can expose. On this account let us continue upon the convalescents the thermometric observations begun upon them when sick.

In "childhood," particularly in the youngest subjects, the course of typhoidal temperature is somewhat irregular. The commonest of these irregularities is its extreme mildness; yet the temperature rises in the first days to a higher average than in adults; it passes more quickly into the remitting period, and defervescence is less protracted; but complications often occur, clearly indicated by the temper-

ature. These irregularities of temperature render the diagnosis of typhoid fever very difficult in children.

In "people over forty" the temperature is lower than in younger adults, reaching in the exacerbations of the fastigium only 39°—39.5°=102.2°—103.1° F.; 40° C.=104° F. exceptionally, and in the morning it falls below 39° C. =102.2 F. The course, also, is more irregular. The fastigium seldom lasts over the second week; an amphibolic stage or complications protract the recovery; collapse often occurs; the temperature falls below normal during their convalescence, and in recovery oftener than in younger people. The beginning is often mild, even in fatal cases. Death occurs with a high, but oftener with a moderate or low temperature.

"Anæmic" people recover comparatively early, but are rather subject to complications, to hæmorrhages (not severe), to affections of the brain, lungs, parotid glands, and to bed-sores, more dangerous in them than in other people.

"Previously existing diseases," which persist through a typhoid fever, render its course irregular, more severe, and obliterate its type, even to the death hour. Pregnancy and the puerperal state have this effect, but not by any means in all cases.

As to the effects of treatment on temperature:

The "cold-water treatment," so-called, consisting in cold baths, douches, ice-bags, compresses, wet sheets, etc., is the most powerful. After each application it leaves a depression of about 1°—3° C.=1.8°—5.4° F. and more; six hours or so a febrile reaction follows, which rarely attains to the previous height; otherwise the kind, the extent, the duration of the application diversify exceedingly the results. Greater and more lasting are these results in complete baths and quickly repeated cold packs, especially

for children; when the fever is mild, with a remittent course, the application is to be made at the time of the natural remission. Less, or no effect, is obtained from shorter applications of cold to grown-up people in earlier stages, in severe cases, in a subcontinuous or complicated course, during the ascending height or exacerbation. By the application of cold the type of the course is altered, remissions obscured, exacerbations *dislocated;* the course itself is rarely shortened, rather prolonged, but rendered milder. Also, when the type is subcontinuous it passes to the remittent, though anomalous at first, and further progress follows the remission. Other good effects are obtained from the cold-water treatment foreign to this subject. But as to its results, it diminishes considerably the mortality, and has brought up cases considered desperate.

The early use of "calomel" (30 centigrammes=6 grains), and not so surely of some other laxatives, influence the course by producing remission. This is followed by a rise, not commonly to the former height, after which defervescence, apparently hastened, follows in a remittent fashion. Their recovery takes place earlier than in cases left to themselves, however mild. The early use of calomel delays the rise to the maximum height; if the maxima attain 40.5° C.=104.9° F., it has done no good; and the later it is exhibited, the less beneficial.

"Digitalis" (2 to 4 grammes= 3 ss.— 3 i., or more) in divided doses, for several days in the second and third week, immediately moderates the temperature in a great number of cases, producing in the exacerbation a fall of at least 2° C.=3.6° F., which does not last more than a day. Then the temperature rises again, not so high as before in favorable cases, but remains stationary at a moderate height, with a much depressed pulse, whilst defervescence takes place as usual. Then the pulse recovers from

its artificial retardation, and convalescence has meanwhile advanced.

"Quinine" (1.2—1.8 grammes = ℈i.— 3 ss.), divided in three doses, a few hours apart, powerfully lowers the typhoid temperature; more moderate doses may do it, but are not reliable.

There is no other form of disease in which so numerous investigations and facts have been accumulated as in typhoid fever.

II.—Typhus.

(Syn.: *Spotted Fever, Exanthematic, Petechial or True Typhus.*)

As far as known by accurate but not numerous observations, the "fever" in typhus has a definite, typical character, most readily recognized in mild and medium cases. It differs from the typhoidal, with which, however, it has some analogies. It is shorter than the typhoid, and longer than all the rest of acute diseases which run a typical course. Its initial stage, its fastigium (with two periods), and its defervescence, are each characteristic. Observation of the course of temperature through one of those periods permits a diagnosis of great probability, and through any two of them of great certainty; it even gives the means of distinguishing the mild, moderate, and severe cases. Only in the latter alone is diagnosis sometimes almost impossible. Irregularities in the course, with or without complications, have not been yet characterized, owing to the small number of the observations.

In the "beginning" (particularly with rigor) the temperature rises more suddenly than in typhoid fever, reaching 40°—40.5° C.=104°—104.9° F. in the first evening; on the next morning it recedes between normal, 39.5° and 40° C.=98.6—103.1°—104° F.; again on the second evening it is up to, or above 40.5° C.=104.9° F.; on the third to 41.5° C.=106.7° F.; and on the fourth rarely under 41° C.=105.8° F., often above, even in cases which recover. At this period, neither thermometry nor the other symptoms are able to found a positive diagnosis. Particularly it cannot differentiate typhus from relapsing fever; but it can from typhoid, by its more sudden rise. Etiology (proof of infection) is yet, at this stage, the only foundation of typhus diagnosis.

In "moderate cases," and such as take a favorable course, the temperature has reached its summit on the fourth day. Thence to the three days which close the first week, occurs the turning-point marked by a very trifling decrease of temperature. On the seventh or eighth day a greater remission succeeds, followed in its turn by a rise of a few days in the second week, which, in favorable cases, do not attain the maximum of the first. This happens seldom later than the ninth day, amounts to $\frac{1}{5}$°—2 C. =$\frac{1}{3}$°—3.6° F., lasts from one to three days, and slowly descends. On the twelfth day appears a "preparatory" remission occupying half a day or two mornings. A third and brief rise may succeed—"perturbatio critica"—terminating in true "defervescence;" unless this last has followed the first diminution of temperature of the second week, cutting short all intervening transitions.

In these slight cases the diagnosis remains uncertain during the fastigium, and is confirmed only by etiology. Thermometry offers a probability of typhus when it shows temperatures uniformly ascending in the second half of

the first week, and not much less in the first days of the second; probabilities strengthened by the manifestation of cerebral symptoms, and by the unimportance of all other phenomena, which cannot of themselves found a diagnosis, but help to confirm it. However, thermometry used from the very beginning to the middle of the second week is able to give a valuable diagnosis. The only mistake possible would be in the rare cases when relapsing fever extends into the second week.

In "severe and neglected cases of typhus" the continuous ascent of the exacerbations continues through the first week, attaining 41.2°—41.6° C.=106.16—106.88 F., or more; the remission of the seventh day is absent, the high fever persists through part or the whole of the second week; morning temperature at 40° C.=104° F., evening's 1° C.=1.8° F. more; the remission of the twelfth day is also absent or hardly perceptible; the cases which will recover show a slight declination towards the end of the second week; yet high temperatures rule the mornings and evenings of the third week.

In these severe cases the diagnosis during the fastigium is more difficult than in the mild ones, especially the distinction from typhoid fever; for "severe" cases of typh*us* and of typh*oid* are more alike in the fastigium than "mild" ones. However, the daily maxima are higher in typhus, the tendency to remission is less; these are mere quantitative differences. But against this, rose spots may be copious in typh*oid* and scanty in typh*us*; the brain symptoms may be equally severe in both; liquid stools or profuse diarrhœa may be present in both: therefore let us understand the necessity of being careful in making a diagnosis.

The stage of "defervescence" is usually very characteristic in typhus. It is generally preceded by a short criti-

cal perturbation, a rise of a few tenths to 2° C.=3.6° F. or more above the preceding evening, greater in comparison to the morning; and it follows either in a precipitous or progressive descent. Where the critical perturbation is absent, the defervescence is very gradual. It generally appears between the thirteenth and the seventeenth day, seldom earlier. Postponed terminations are rare or doubtful. The defervescence of typhus falls sometimes in a single night from 40° C.=104° F. or higher, to normal; quicker than in typhoid fever; but never so low as in relapsing fever: characters which, in connection with the preceding course, serve to distinguish the typhus from other diseases.

"Fatal cases of typhus" announce themselves from the beginning by the enormous height of the temperature, 41.2° C.=106.16° F., and even more. There is no remission at the end of the first week; death may occur in the second, or the case enters the third after some remission about the fourteenth day, which is soon compensated. Yet, even in fatal cases the temperatures of the third week are not so high as in the former, at least till the death-agony; the danger during that week being indicated, not by the height, but by the continuance of the fever. Just before death, and in the death-agony, the temperature rises constantly from 1.25°—3.6° C.=2.¼°—6.48° F.; average 1.8° C.=3.24° F. During the agony I observed 40°—41°—42°, and once 43° C.=104°—105.8°—107.6°—109.4° F. The course of the fever in typhus was first demonstrated by me, and confirmed by Griesinger.

III.—Relapsing Fever.

(Syn.: *Typhus Recurrens*, *Famine Fever*, *Fièvre à Rechute.*)

Relapsing fever shows itself in two forms, the "recurrent or relapsing," and the "bilious typhoid" of Griesinger.* The course of the relapsing fever is typical; two, three, seldom four attacks run a continuous course of several days with a remarkable height of temperature, interrupted by intervals of several days free from fever. The bilious form far rarer and less studied, runs a course quite similar. Yet, both in fatal and in recovering cases the second attack is often wanting, and the following apyrexia too; thus the peculiarities of the type are lost.

The disease generally "begins" with rigor and a rapid rise of temperature to 40°—41° C.=104°—105.8° F.; course continuous, interrupted by solitary *peaks* of exacerbation, of 41°—42° C.=105.8°—107.6° F.: two or three elevations in a day are rare. The fever-"paroxysm" lasts from three days to thirteen, and average from five to seven. A descending direction is first perceived at the end of the paroxysm, or if this is protracted, a few days before the critical period. This period is one of great and lasting fall, remissions as low as 38° C.=100.4° F.; exacerbations slighter.

The height of the temperature immediately "before the crisis" is commonly 39.8°—40.5° C.=103.64°—104.9° F.; and the downfall now occurs with extreme rapidity (accompanied by perspiration or not) from 3°—6° C.=4.4°—10.8° F. in an unbroken line in twelve hours.

According to Zorn, in the "bilious form" the fever is

* Is not this the true "bilious fever" of our old authors?—(W. B. Woodman.)

not so high, from 39°—40.5° C.=102.2°—104.9° F.; many cases prove fatal at the first attack; the fall is rapid too, turning sometimes the fever into bilious typhoid. This evolution follows fresh rigors, and is followed by copious perspiration; others have a protracted defervescence.

A period of apyrexia, free from fever, follows the defervescence; it lasts from four days to two and a half weeks; normal temperatures, with healthy daily fluctuations, are rare at this period; more common are undulated elevations.

After reaching its lowest point of defervescence, the temperature rises again from subnormal to normal, or higher: an ephemeral movement followed by a return to normal. Sometimes a fresh elevation may occupy the next day, and such fluctuations may occupy several days, or at others be entirely absent, or take place within normal limits. Thus the apyrexia is divided into two almost equal parts, the first dangerous, often mortal in the bilious form.

The "second attack" or "relapse proper" is oftener met with in the remittent form. Its beginning is quite sudden, rising in an abrupt line, in a few hours, at most in twenty-four, to 40°—41° C.=104°—105.8° F.; but still almost always remaining under the maximum of the second fever period. This second period is of three or four days, versatile in temperature which ascends or continuously, or interruptedly through deep depressions, or is marked by pointed paroxysms. The "peaks" thus formed (rarely more than one in a day) grow higher and higher, and the last represents the maximum of the second fever period, which is rather higher than that of the first attack, 41°—42.2° C.=104.8°—107.6° F.: hardly any other disease rises so high in cases which recover.

The intercurrent remissions are all inconsiderable but one (first or last), which tops the others by 1°—3° C.=3.6°—5.4° F. In the intermittent form the remissions last

longer, and the paroxysms rise higher than in ordinary malarial (fever and ague). Defervescence succeeds, with or without perspiration, by a rapid and unbroken fall of half a day to 4°—7° C.=7.2°—12.6° F., even below the normal: isolated fluctuations are sometimes met at the end of this fall.

Relapsing fever generally terminates with this second defervescence, whose fall is greater than that of any other disease. Death may occur, even after the cessation of the fever, a third or even a fourth attack (second and third relapses) may appear, but are less acute, less exacerbated, less fatal.

Thermometry does not yet throw any light on the fatal terminations, which occur in the fiercest paroxysm, in extreme collapse or in other conditions. In my only fatal case, the second attack was followed by an amphibolic stage of fluctuations of a week; he died at 41.4° C.= 106.52° F.

IV.—Variolous Diseases.

The fever in variolous diseases exhibits "two distinct types," corresponding to the forms of small-pox: a "brief continuous," to varioloid, occurring chiefly in vaccinated persons; and a "relapsing type," to the variola vera, which attacks oftener the unvaccinated.

The "initial fever" has nothing typical. On the contrary, that of the "eruption-period," taken in combination with the outbreak of the exanthem (even before this has any character), gives a perfect diagnosis. The initial temperature does not distinguish variola from vario-

loid, and affords no aid to predict the severity of a case; but its course after the eruption is full of import. That initial period is common to both types. On the first or second day its temperature is seldom below 40° C.=104° F., reached in an unbroken line, with rigor and shivering, or more slowly in the second evening, after a morning retrocession. In patients previously ill (phthisis, etc.), this rise may be lower and slower. The temperature may have attained its maximum the second day, or continue to increase till the fourth, with slight morning remissions. When the maximum of this initial stage is reached (41° C.=105.8° F.), a fall of one day begins immediately. At this time, the first traces of eruption in the form of spots may be noticed. This stage of two to five days is one of uncertainty; every day that passes without lung symptoms, renders pneumonia improbable; but if the fifth day passes without traces of eruption, small-pox is not likely.

Soon after the formation of the papules, "the temperature falls more or less rapidly," from the second to the sixth day; if that downfall lasts one day it is continuous, if two or three it is interrupted by evening exacerbations. In this downward course the temperature soon reaches the normal point, and remains there, unless modified by complications.

The eruption of "varioloid," when abundant, may be initiated by a slight febrile movement, but its most trusty character is a fall of temperature. This fall distinguishes small-pox from measles, typhus, etc., and if it soon reaches normal, it characterizes also the varioloid from the variola vera.

In "the variola vera" (true small-pox) the falling temperature does not quite reach normal, but remains subfebrile, or decidedly febrile; or reaches normal, if at all, through tedious lysis. Then, with the congestion of the skin renewed in the suppurative stage, the temperature

rises again. This suppurative fever is of indefinite duration, varied like the incidents of the disease, and its temperature is commensurate with its severity: a moderate variola hardly reaches 39° C.=102.2° F.; irregular fluctuations up to 40° C.=104° F. are dangerous; in fatal cases above 42° C.=107.6° F. may be reached at death; though a patient may die with a moderate temperature. In non-fatal cases the secondary fever lasts about a week; in favorable ones it defervesces gradually by lysis, or during the scabbing and desiccation time fever may continue even longer.

IV.—Varicella.*

In the incubation stage of varicella there are slight elevations of temperature, and large ones, too, from 38°—40° C.=101°—104° F., after a copious eruption has cropped out. High stage of two to five days, fever remittent, temperature proportionate to the eruption, maximum of temperature attained in the first, oftener in the second half of the fastigium, morning remissions more considerable after than before the maximum, defervescence complete in half a day: such are the results of the observations of Thomas, confirmed by my own.

V.—Measles.

In "measles" the fever precedes the exanthem, and

* The translator of the New Sydenham Society has transferred this from No. VII. here, to follow the classification of Hebra.

accompanies it to its fullest development. Its typical character is pretty strongly marked. But as measles is subject to many irregularities from beginning to end, so is the course of its temperature; and since it is "the disease" of children and young people, whose temperature is the "most sensible to accidental influences," it constantly exhibits strong variations from the type met in previously healthy individuals.

At a time in which the infection has been taken, the "incubation stage," but in which no means of observation can recognize it, Thomas notices the presence of a short preliminary fever-course (ephemera protracta), whose maxima are 38.8°—49.8° C.=102.84°—103.64° F., followed by a pause of several days.

The "ensemble" of symptoms of the measles commences with its initial fever, which is complete in twelve to twenty-four hours, and whose rapid rise, 39.1°—40° C.= 102.38°—104° F., is attained in the evening; 38.1°—39° C.=100.5°—102.2° F., being exceptional. Yet it is exceptional, too, for this first rise to attain the "maximum" of the whole course of the measles. However, the degree then attained is an index of the future elevations, which are wont to exceed the initial by $\frac{8}{10}$°—1° C.=1.5°—1.8° F., or a trifle more. The initial rise is habitually followed by a downfall the next night, so that in the morning the temperature is normal, and seldom exceeds 38° C.=100.4° F., except in very anomalous cases; this depression may last a few hours, till night or till the next morning. The rise and fall of temperature are so rapid in this stage, that it looks like intermittent, but for the lowness; or it may be confounded with an ephemeral fever, but for the appearance of the ocular and pulmonary symptoms.

The "true eruptive fever" begins with a fresh rise of temperature, which will have but temporary remissions

till the exanthem is fully developed. In most cases the eruptive fever is divided into two sections, a moderately febrile stage and a fastigium or acme.

The "moderately febrile stage" averages thirty-six to thirty-eight hours, made up of one or two exacerbations of 38°—39° C.=100.4°—102.2° F., not quite to the level of the initial fever: if two exacerbations, the second is the higher, the intervening remissions are not so deep as those of the initial stage, yet one of them may reach normal.

The "fastigium" commences early in the day, or late, leaving behind all previous height; if early, the evening temperature is higher, the next morning presents a slight remission, and the next evening the maximum. If the acme begins in the evening, the next morning the remission is slight or null.

In normal cases "the maximum of the acme" is cotemporaneous with the fulness of the exanthem; in others it may precede it by the effect of some complication. The fastigium lasts from one and a half to two and a half days, and the eruptive fever is completed in from three to four and a half days; a course that complications may prolong.

Decided "defervescence" begins, according to rule, in the night, and ordinarily runs a rapid course, reaching normal on the second morning, though one or two slight evening subfebrile heights may undulate the descent. Defervescence may also be protracted by bronchitis and other complications; when a case began irregularly its defervescence may do the same; and besides, trifling causes elevate the temperature of children. But sometimes a recrudescence of the fever is caused by an "after-stroke or recoil" of the exanthem; this may raise the temperature almost to the former maximum, but very transiently.

"Complications" alter the typical course of measles-temperature somewhat to their own type. Since fatal termi-

nations, in cases of measles, are due to complications, the last temperatures are subordinate to these complications.

VI.—Scarlatina.

(Syn.: *Scarlet Fever.*)

Scarlatina conforms far less closely and regularly to its type than the previous diseases to theirs; yet there is an apparent conformity in the cases which differ widely in other respects; evidently the deviations appear as exceptions to a rule.

Cases of abnormally mild scarlet fever are tolerably common; so trifling their symptoms that they receive no medical care, and fatal sequelæ often ensue. But the course of the fever is often quite characteristic when the scarlatinous infection develops only a rudimentary disease, or even only an angina without any eruption.

In all cases of tolerably severe scarlatina the first symptom (with or without others concomitant) is a rapid temperature, steady rising, with shiver, to 39.5°—40° C.= 103.1°—104° F. The exanthem follows this rise or appears the next morning (second day); if it delays the temperature continues to rise, with slight morning remissions, beyond the considerable height reached at first, till the exanthem has covered the whole body, and even till the parts first attacked grow pale. The duration of this invasion-stage is from half a day to four. The height thus reached is from 40°—41° C.=104°—105.8° F. As a rule the height is parallel to the intensity of the exanthem; though, exceptionally, the eruption may be slight with a

high temperature, and, more rarely, the eruption copious with a moderate fever. The high ruling course of scarlatina distinguishes it from the other exanthematous affections, typhoid fever, etc.

"Defervescence" is not always alike. After a moderate exacerbation it may exceptionally fall and reach normal in half a day; but in most of the cases it requires three to eight days for its completion. From day to day the temperature gets lower and slopes like an easel, or through trifling remissions, falls by night, keeping up, or almost so, by day, till it reaches normal. Seldom does this remitting defervescence liken itself to that of typhoid fever. The defervescence of scarlet fever may, like others, be delayed by complications. A subnormal temperature may set in before the normal is assured, or a collapse. This form of defervescence is quite typical of scarlatina—at least not often met with in other diseases, except occasionally in typhus and catarrhal pneumonia.

An "anomalous course" is not infrequent in scarlatina. The temperature may remain rather low—this does not exclude danger; or its descent may be interrupted by fresh exacerbations—this may be traced to some complications, but not always, and retards the recovery. There is also a peculiar typhoidal condition, with persistent cerebral disorders, diarrhœa, meteorism, and enlargement of the spleen, during which (a fortnight or more after the fading of the eruption) the fever remains high, subcontinuous or remittent in form, yet generally takes a descending course.

During "convalescence" the temperature remains normal, unless affected by complications, fresh diseases, or a second eruption; therefore the persistence of normal temperature is a guaranty, contrarily a fresh rise is a signal of danger.

In "fatal cases" the temperature is very varied, and ruled by the contemporary circumstances. If death happens during the eruptive stage, the temperature may range high, yet fall at the death-agony; if after the height of the eruption, either fresh elevations or fall of temperature precede death. Cases occur where the temperature rises enormously and suddenly before death; in one of my cases it reached 43.5° C.=110.3° F.

VII.—Rubeola.

Rubeola (an hybrid between measles and scarlatina, which needs the experience of an extensive epidemic to distinguish its peculiar characters) generally, but not necessarily, shows a subfebrile, or moderately febrile temperature during the eruption; higher temperatures depend upon complications, or the youth of the subject.

VIII.—Erysipelas.

Facial erysipelas is pre-eminently a polytypical disease, and in many cases atypical. This may be due to the fact that the same anatomical changes which bear that name are brought on by varied conditions, and may have varied significances: the erysipelas arising from the local irritation of wounded parts; that brought about by local predispositions; that connected with gastric and intestinal disturbances; the protracted, erratic, or vagrant; the kind analogous to an acute exanthem, especially the primary and spontaneous; that arising from pyæmic infection;

that of glanders; that which is developed in marasmus; that preceding death, have hardly anything in common but the local dermatitis and the name. The temperature differs widely in these cases. Erysipelas of other parts than the face is quite as atypical.

Excluding the cases free from fever, erysipelas "begins" with chilliness, by a rise of temperature to 40° C.=104° F., ordinarily reached in a few hours, rarely in a few days; after which the inflammation of the skin is noticeable. The "fastigium" is of the most varied character—from a single slender peak of short duration, to (oftener) high temperatures; continuous or subcontinuous, still rising with slight morning falls to or above 40° C.=104° F., till the cutaneous process has fairly developed. There are exceptional elevations of 42° C.=107.6° F., and openly remittent and intermittent fastigiums.

The "maximum" occurs one or two days before the end of this fever. A trifling moderation succeeds, and a critical perturbation precedes the "defervescence." This reaches a normal point in twelve hours, unless an evening rise interferes, and puts it off to twenty-four. The cases in which defervescence assumes the remittent form (more rapid, however, than in typhoid fever) are those whose fastigium has been subject to considerable daily fluctuations, and whose dermal inflammation is still progressing. When the eruption ends with defervescence, convalescence follows undisturbed.

After a few days "a fresh and striking rise of temperature" may accompany or herald a new extension of the inflammation of the skin; this relapse lasts but a few days, and may be repeated several times: as long as there is eruption there is elevation of temperature.

In "fatal" termination death is accompanied with high temperatures; it was so in the cases observed by myself.

IX.—Remittent Fever with Phlyctenular Eruption.

(Syn.: *Miliary Fever.*)

This disease is distinguished by an exanthem peculiar in form, situation, and course; by some typhoidal symptoms, by diseases of the respiratory organs, and by the course of the fever. A case I observed was a continuous remittent, with evening temperatures above 40°—41° C.= 104°—105.8° F., and morning remissions of 1°—2° C.= 1.8°—3.6° F. (no temperature taken the first week). From eight to fourteen days the temperature decreased by large fluctuations, as in typhoid fever; from day to day the remissions became more marked, the exacerbations less, till normal temperature appeared first in the morning; but this course may be considerably protracted by relapses.

X.—Febricula.

There are two courses of temperature known as "febricula." One, longer or shorter, whose evening exacerbations rise very little above subfebrile, and only occasionally higher. The second kind includes brief fevers (*ephemera*) ending in recovery, in which the first symptoms of indisposition are accompanied by a rise of temperature of 2°—3° C.=3.6°—5.4° F., with or without rigor. The fastigium is of a few hours, or at most a day; as high sometimes as 40° C.=104° F., followed by a rapid fall, and restoration is sometimes protracted several days.

"Wounds" (from an operation, etc.) involve febricula. "Considerable injuries" are followed by traumatic fever

in twenty-four hours (average maximum 40° C.=104° F.). When the maxima of the first two days are alike it is a better sign than when that of the second is higher. The length and the height of the fever have no connection. If the height remain considerable, a new diagnosis is necessary. The defervescence is expected inside of the third day. Age and constitution influence the course of traumatic fever.

On the other hand, an injury with considerable hæmorrhage, is followed by a proportionate fall of temperature, but reaction soon follows. If a chronic fever, consumption, Bright's disease, etc., existed before the injury or operation, the traumatic fever is more acute. Frequently the wounded experience on the fourth day a "secondary fever," whose temperature is varied, being mostly the expression of constitutional habitus. The febriculæ are atypical.

Thermometry can decide, in cases of "abnormal uterine action," whether the pains are cramp-pains or colicky. During insufficient labor-pains there is no elevation of the temperature, which rises in proportion to the duration of the pains (average 1° C.=1.8° F.). After labor the temperature remains high, but falls after twelve hours, unless kept up by inflammation.

In "child-bed" a temperature above 38° C.=100.4° F. is at least suspicious, whilst a normal temperature does not insure an undisturbed recovery. A species of mild traumatic fever may follow delivery within twenty-four hours, and last as long; when coming later it is stronger, with distension of breasts (milk fever). It reaches its maximum, 40° C.=104° F., in a few hours or days, and in the absence of complication the fall of temperature and defervescence rapidly ensue; but if a secondary fever sets in, it may reach 42° C.=107.6° F. before descending to the

normal point. All deviations from the above course are signs of a more severe disease.

"Ephemeral fevers" also occur in weakly or sick people, and women and children, without assignable cause; with rapid growth, dentition, exhaustion, or menstruation; they indicate the beginning or increase of some morbid process; are prelude to transient disorders of tissues, like the eruption of herpes on the lips; during the incubation of some infectious diseases; simultaneously with the spread through the body of a morbid poison through the lymphatics, or with the formation of an embolic obstruction, or as a sort of reaction against severe chills, a complete drenching, powerful emotions, etc.

XI.—Pyæmia.

"Pyæmia," the fever which accompanies acute severe lesions or the puerperal state, has its genesis in infection, and its commencement is sharply defined. It commences with a severe rigor, by an elevation of temperature often brought in a few hours to 2½°—3½° C.=4½°—6½° F., and exceeding 40°—41° almost 42° C.=104°—105.8°—107.6 F. This first paroxysm takes an acuminated form.

After the temperature has reached its highest peak it begins to fall fully as rapidly as it rose, sinking from 2°—4° C.=3.6—7.2° F. in a few hours, descending lower than it was before the paroxysm. As soon as it has reached its minimum depth, it begins to rise again; a "brusque" rise, more or less approximating the summit of the first paroxysm, is scarcely ever absent, subject to rhythmic repetitions, two or three in a day. Then follows a downfall of tem-

perature after the manner of a rapid defervescence, coming down to normal, or pausing at 39° C.=102.2° F.; these pauses rarely last a whole day. Intercurrently, and more so towards a fatal termination, appear segments of a continuous or remittent course.

The "duration" of pyæmic fever is a week or so. In it death does not affect any particular temperature.

But "deviations" occur. Death may occur at the beginning of pyæmia in patients suffering from other diseases. The course may be continuous, particularly in traumatic pyæmia, or assume a zigzag shape, or affect a certain rhythm, or be protracted, and through successive improvements lead to death or to unexpected recovery.

XII.—Catarrhal Affections of Mucous Membranes.

The temperature of catarrhal affections of mucous membranes has no particular type. There may be no alteration of temperature, as it may be supranormal, subfebrile, or moderately febrile; if anomalous elevations occur, they are attributable to some malignancy, as whooping-cough, where it is safe to take daily observations. Little children, young and delicate people, already subject to catarrhal affections, present ephemeral extra-elevations which, protracted, end in hectic fever.

The temperature may assume an almost typical form in epidemic catarrh of the respiratory mucous membrane, when associated with gastric and intestinal catarrh, or with the nervous symptoms of influenza. Indeed, it is in the latter only that any considerable alteration of temperature is met with. It begins its ascent similarly to typhoid

fever, though not quite so regularly. The same comparison holds good during the fastigium, which, however, is shorter; and during the defervescence of a remitting type (lysis), running its course more rapidly, closing it more punctually. On the other hand, in influenza the temperature may, after almost reaching the normal point, linger somewhat above it with greater evening exacerbations than is consonant with complete recovery. In presence of these pyretic symptoms the question arises: Is this a severe influenza or a case of typhoid fever? The approximate identity of the other symptoms in both diseases, augments the uncertainty. In young adults, a range of temperature lower than in typhoid fever excludes it; otherwise the diagnosis must be deferred. In febrile gastro-intestinal catarrhs the course of the temperature is quite similar to that of influenza, but falls more quickly with good nursing.

XIII.—Croup and Diphtheritic Inflammations of the Mucous Membranes.

In no other acute affection has the temperature so little significance as in croup and diphtheritic affections. High temperatures *add* to their danger, and yet are followed by recovery; whilst moderate and even normal temperatures offer no guarantee against fatal terminations. (See Richardson's "Temperature in Diphtheria," in New York *Medical Record*, 1867, ii. 219.)

XIV.—Pneumonia.

The diseases comprehended under the name of "pneumonia" have a manifold thermometric course, which, instead of being an anomaly, must be regarded as an indication of the wide differences existing in the diseases comprised under that common appellation, and recognized after anatomical observations under the sub-names of "croupy, hæmorrhagic, serous, embolic, purulent, putrid or septic, lobar," etc., and of others whose anatomical characters seem identical, but whose other characters and etiology differ.

The term pneumonia is about as broad and unspecific as dermatitis; yet it is useful, because, while the patient is living, it is often impossible to differentiate from one another the different morbid processes which it covers with its generality, and which have not yet been clearly mapped out.

Thermometry, "itself and alone," cannot decide as to the presence or absence of pneumonia, but it can demonstrate differences in the special forms which can be recognized by no other means; it can determine the degree of the affection and its danger; furnish a delicate standard of improvement, relapse, and effects of the medication; indicate the occurrence and persistence of complications; determine the completion of the processes; guarantee the certainty of convalescence and recovery; give warning of the continuance of disorders, or of the supervention of sequelæ; and indicate the intervention of pneumonia as a complication in measles, bronchial catarrh, whooping-cough, pulmonary consumption, and pleurisy. Therefore thermometry has only an "accessory value" in pneumonic affections, instead of a direct value as in typhoid fever, etc.

There are exceedingly rare cases of pneumonia running

its course without any fever; and others, quite as rare, with a very moderate and almost momentary elevation of temperature, hardly 38.5° C.=101.3° F., for a few hours in the first or second day.

Somewhat akin to these are two "pneumonic febriculæ," one with rigor, abrupt, rising above 41° C.=105.8° F., immediately succeeded by a rapid defervescence (ephemera with pointed peak). In the second, the highest point, 40° C.=104° F., is reached the third day only; the temperature declining at once (ephemera protracta). All these febriculæ are accompanied with local processes, and are rendered dangerous only by their surroundings. They correspond to slight œdematous infiltrations, secondary pneumonias, mild inflammation of the lungs in young children, and phthisis in old and emaciated persons, etc. These forms may be considered as rudimentary copies of the two types of pneumonic fever: imagine the sharp peak of the first form of ephemera flattened out, it represents the continuous type with its sudden commencement and rapid end; imagine the ephemera protracta extended, we have the remittent type, with its gradual commencement and defervescence by lysis.

The fever of pneumonia shows brusque elevations and intercurrent falls of temperature. The "brusque elevations" in the course of the fever reach 41.5° C.=106.7° F.; when interrupting defervescence, 40° C.=104° F. The "intercurrent falls" occur in almost any form of pneumonia, whether slight, severe, or fatal, ranging from 1½°—4.5° C. =2.7°—7.2°, even 9° F., reaching the normal temperature, or below it, very rapidly, to rise again speedily.

The intercurrent decline of temperature happens in severe or slight cases, from the second day to the last of the defervescence, even to the death-agony; it may repeat itself more than once. This intervening downfall divides

the fastigium into two periods, it may be regarded as a moderation in the attack; if several times repeated it may be a transition "to the remitting type;" but if it occurs abruptly and with regularity, pneumonia becomes "truly intermittent;" if less punctual it looks like the "pyæmic type;" if the low temperature persists and fresh elevations occur only after two or three days, we have the "relapsing form." The fall of temperature before the death-agony is equivalent to a pro-agonistic stage.

As for the causes of these falls of temperature, they seem to result from therapeutic measures, sufficient to perturbate, not to destroy the disease; or from local processes, terminating in one part, beginning afresh in another. It is not always possible, though it would be of the highest importance, to distinguish a pseudo-downfall from a genuine defervescence. The earlier the fall, or the less expected, the more must we look at it with apprehension as representing a pseudo-crisis.

The "continuous and subcontinuous" types occur chiefly in acute primary (croupy) pneumonia, more rarely in secondary; beginning with rigor and an abrupt rise from 39°—41° C.=102.2—105.8° F. or more. There is often no other symptom, and only occasionally cough, pain in the chest, and dyspnœa. Auscultatory symptoms are rarer till the fourth day than headache, delirium, vomiting, loss of appetite and general depression, with strong fever. Meanwhile the temperature is 39.2° (mild)—40° C. (severe)= 102.56°—104° F., with brief remissions of ¼°—1° C.=½° —1.8° F., and quickly returning exacerbations, often more than one of the latter in a day. This course lasts, as the pathological process in the lungs, from three to seven days, with variable or steady daily maxima and minima. Oftener the daily average grows higher till the afternoon of the third day, and thence declines a few tenths from day

to day, even in fatal cases: this steady fall may be attributed to the medication or nursing. This downward tendency may be observed even in the fastigium.

Death may occur in low temperature; or in a pro-agonistic rise, when accompanied with suffocation, to 40° C.= 104° F.; with nervous symptoms to 41°—43° C.=105.8° —109.4° F.

In favorable cases the descending direction becomes visible as soon as after the occurrence of the maximum, which is attained early; or after a downfall of temperature whilst the remissions become more striking and the exacerbations diminished.

On the last day but one of the fastigium "a pseudo-crisis" often takes place; great fall, followed by a considerable rise, precedes the "defervescence." This generally begins in the evening, from the fourth to the tenth day or later, marches rapidly (in twenty-four to forty-eight hours) to its completion. The nervous symptoms may last through this period, severe bronchitis or acute pleurisy may hinder it; relapses also will occur; and finally, subnormal temperatures or collapse may set in till, through fluctuations, the normal condition is confirmed.

Many cases of pneumonia do not conform "so perfectly to the continuous type." For example, the beginning may be less rapid and abrupt, lasting two days more till the temperature reaches its high level; or the temperature may remain lower than in well-developed pneumonias, or approximate the "remittent type" by great fluctuations, or the "intermittent," or the "relapsing" by great falls; or the acme may be unusually severe and protracted into the second week, as in double pneumonia, or in the acute pneumonia of the upper lobes, or when a whole lung is attacked; in which cases the acme is prolonged and its latter part is marked by fluctuations and amphibolism;

then defervescence will be protracted and complicated with slight elevations of temperature. Accidental influences, idiosyncrasies, youth, old age, previous diseases, and complications, cause pneumonia to deviate from its regular course. Injudicious treatment is also a cause of deviation.

But the "most decided influence on the course of the fever is brought about by a sufficiently copious bloodletting or a spontaneous hæmorrhage." Emetics, digitalis, veratria accomplish the same, somewhat more slowly, and nitrate of potash, aconite, etc., not so surely; but it depends on circumstances whether this sedative action will initiate defervescence, or induce a febrile reaction. Another cause of perturbation, not demonstrable, only surmised, is an infiltration approximating to a hæmorrhagic form or œdema.

A "remittent" course may occur in pneumonias almost at any period, developed from protracted bronchial catarrh, influenza, measles, etc., and is common enough in children and old people.

Its fastigium somewhat resembles that of typhoid fever, but seldom reaches its maxima or follows its regularity.

On an average, the duration of the "remittent" pneumonia exceeds that of the "continuous;" it rarely terminates by rapid defervescence, but is sooner effected by the morning remissions becoming greater, and the evening exacerbations growing less; in less time, however, than in typhoid fever. Remitting is more subject than continuous pneumonia to imperfect convalescence. Transitions between these two types are by no means rare. Whether there is bronchitis or pneumonia during a remittent course is judged by the acoustic symptoms; but pneumonia is highly probable with exacerbations at 40° C.=104° F.

The differential diagnosis from typhoid fever is rendered more difficult if infiltrations of the lungs intervene; be-

sides, cerebral, abdominal, and spleen symptoms are similar to the typhoidal; but in favorably progressing pneumonia the difficulty is less, and overcome by about four days of thermometric observation.

A recrudescing fastigium occurs in the continuous as in the remittent type, when the hepatization of one part is followed by the invasion of another. Unless death occurs, the convalescence of the remittent type differs from that of the continuous only by some irregularities and delay.

Sometimes the fever in pneumonia displays a "relapsing" course: large bleeding has caused it. These relapsing cases are allied to those marked by pseudo-crises with great apyrexia. Sometimes "erratic pneumonia" exhibits a relapsing form (erratic in relation to the rapid invasion and resolution indicated by means of physical diagnosis).

The "intermittent" course is closely allied to the "relapsing," but has a more regular rhythm and more sharply defined apyrexia and paroxysms. This form is perfect during epidemic of intermittent, and is observable in embolic pneumonias.

The "intermittence" of pneumonias may cause two mistakes: one, to take defervescence for the end of the disease; the other leads to the belief that the periodic symptoms are those of intermittent fever. However, the attacks of intermittent pneumonia become themselves soon weaker, and may terminate by simple absence of rise after defervescence, and by the establishment of convalescence. I have never seen it end fatally.

The "abrupt course," with its imperfect falls and fresh irregular elevations, resembles, pyæmia, and is doubtless pyæmia due to the lungs' disorders, be they embolic or septic processes with multiple foci, whose course ends in death.

Pneumonias with "protracted course" display no particular character at the commencement of the attack; they are either continuous or discontinuous; but later, remissions occur, and instead of showing a tendency to recovery, the fluctuations aggravate and alternate with repeated collapses. Generally the daily maximum occurs at noon, the remission in the evenings, with a great tendency to collapse and an exacerbation about midnight. But this tolerably regular course only lasts a few days. If the patient does not succumb, the transition toward a state free from fever is long, gradual, and almost imperceptible.

Terminal pneumonia, "la pneumonie des agonisants," does not necessitate an elevated temperature; which is brought on by accessory causes, not by the pneumonia itself.

XV.—Amygdalitis.

(Syn.: *Tonsillitis—Quinsy.*)

In tonsillitis, as in pneumonia, the fever and the local disorder are simultaneous; but in not a few cases the fever (resembling the prodromal fever of an exanthem) precedes by one or more days the development of the tonsillar angina.

At the "beginning" fever is accompanied with rigor or strong sensation of chilliness. The initial temperature has not been sufficiently observed; it reaches its maximum commonly on the third day; in the parenchymatous form between 39°—40° C.=102.2°—104°; in the catarrhal under 39° C.=102.2° F. The course of the temperature in both forms is "discontinuous" during the fas-

uous, recovery does not take place by crisis but by lysis; as the temperature approaches normal the pulse begins to quicken. Once in a while after defervescence, in the midst of apparent recovery, a relapse sets in, the temperature rises rapidly toward the end just described. Other cases are more "protracted;" the height of their temperature shows manifold changes, depending upon bronchial, pulmonary, intestinal, or serous complications. The curves greatly resemble those of typhoid fever, less their regularity, more like it in its amphibolic period; or resemble the fever of phthisis. Defervescence, rarely rapid, takes place by lysis. The rise or fall of the final temperature depends on the immediate cause of death.

XVIII.—Pleurisy, Endocarditis, Pericarditis, and Peritonitis.

The majority of inflammations of the serous membranes present no typical character, and may run their course with or without elevation of temperature. Associated with another disease, they retard its defervescence, and otherwise cause irregularities in its pyretic course.

In spite of the great number of temperature-curves of serous inflammations that I possess and have compared, I have not been able to discover in them more significance than the following. There is no course of temperature which can be considered as denoting safety. The course is "probably" favorable when the temperature remains normal or a little above (not below), with a moderate remittent type, lasts but a fortnight, and then gradually subsides, without leaving behind any suspicious symptoms. Subnormal temperatures are especially common in

peritonitis, and always suspicious; death may follow them closely. High and rising temperatures do not add, *per se*, arguments for an unfavorable termination, although adding another dangerous element to the case. It is not so much the actual height, as its constancy, which must be feared; as are also great and irregular fluctuations between very high and very low temperatures, similar to pyæmia, common in endocarditis, less frequent in inflammations of the pericardium, pleura, and peritoneum; those are always highly dangerous. Hyperpyretic temperatures are especially met in peritonitis (puerperal form); they lead us to suspect an infectious origin, and indicate a speedy death with a high temperature. The forms of peritonitis in child-bed, which run their course without much elevation of temperature, are apparently to be grouped among local affections.

XIX.—Acute Rheumatism.

The comparison of a few cases of rheumatism shows extreme discrepancies. Fever absent, moderate, intense, brief, protracted, continuous, remittent, etc. But the comparison of a great number of cases shows that these discrepancies may be reduced to certain groups and primary forms. And first, nearly half of the cases of acute rheumatism display a moderate amount of fever, which rises gradually, lingers a few days at its maximum, and descends with moderate remissions in two to three weeks; and though sensitive to external influences, is little affected by the occurrence of other inflammations. There is a discrepancy between the temperature and the pulse; no weekly cycles are observable.

The course is divisible into an ascending or "pyrogenic stage;" height of fever, a solitary "peak," or an "acme" of several days; and "descending temperature," which loses itself in "defervescence." The "beginning" seldom comes under observation; we know by report its rise to be more tedious than that of typhoid fever, though there are exceptions of 40° C.=106° F. reached in two to four days; but in good ordinary conditions the temperature is still very moderate at the end of the first week. Even the "height of the fever" escapes clinical observation. In the majority of hospital cases the "maximum" is reached the day of admission or directly after; the temperature beginning to decrease the same evening, rarely later. This course indicates either that the removal of rheumatic patients is injurious, or that good nursing soon alleviates the symptoms. Also, it appears that the earlier the reception into the hospital the quicker the fall of temperature.

However, the "maximum" often presents a solitary peak, is quite 40° C.=104° F., exceeding the previous temperature by 1°—2° C.=1.8°—3.6° F., or more, occurs in the evening between the fifth and ninth day. The summit may extend into an actual fastigium, brief in comparison to the duration of the disease, shorter in proportion to the height of the temperature, the latter under 40° C.=104° F. The "fastigium" is longer than the succeeding period. Its course is either continuous, exacerbating, subremittent, or considerably remittent.

The course of the "descending" period depends on its form and suddenness. In favorable cases it is quick and assumes the form of zigzag, a defervescent lysis of five to six days. A more rapid downfall, like a crisis, is exceptional. During the convalescence the temperature fluctuates on a plane of a few tenths higher than in healthy persons, so that the evening rise is almost febrile. Al-

together the fever of acute rheumatism is only moderate and of medium severity.

But there are many "exceptions" to this medium and favorable course. "Abnormally mild cases" are particularly common. We cannot tell why the fever is so slight or absent, when the joint-affection is so severe, or even cardiac complications present. The other severe deviations do not amount all together to one-sixth of the cases. Among them the commonest is the "protracted." Numerous abnormalities protract it four or five weeks; the temperature may be normal in the morning, and even exceed 40° C.=104° F. in the evening. In a single day large fluctuations, as 3° C.=5.4° F. or more, show themselves when the affection of the joints becomes fixed.

"Recrudescences" of fever, or apparently objectless intercurrent elevations of temperature of 2° C.=3.6 F., come right in the middle of a moderate course of fever, ephemeral or lasting, without evident connection. More slowly developing and protracted elevations may be associated with a relapse. The cases artificially depressed by digitalis, aconite, etc., and rising again when the medicine is left off or its therapeutic action exhausted, may be classed as apparent recrudescences.

"Complications," especially pericarditis and endocarditis, have no effect on the course of the fever, or modify it as follows: In pericarditis and endocarditis, when they have produced valvular mischief, the temperature may remain unaffected during the fastigium, but becomes higher in the convalescence than usual, and it takes considerable time to come down to its normal condition. With fresh development of aortic valvular deficiency great elevations of temperature arise late in the disease; not so in mitral insufficiency. Other elevations are due to complications; pneumonia, for one.

When articular rheumatism becomes fixed in a joint or bone, it may hang about a long while through recrudescence and complications, and displace itself with or without fresh disturbance of temperature. Such obstinate cases have occurred to me more frequently in private than in hospital practice.

Among the fatal affections which accompany acute rheumatism, or have rheumatoid symptoms, one class is "fixed localization." Death, in these cases, does not result from the rheumatism itself, but from the unfortunate course taken by some local manifestation or accessory to it. Another class is dependent less on rheumatism than on "a malignant character" revealed from the beginning or during the further progress of the rheumatism; the most common of them are rigor, intense fever, severe nervous symptoms, jaundice, hæmorrhage, diarrhœa, enlargement of the spleen. Death generally occurs with considerable, sometimes enormous elevations of temperature, 43°—44° C.=109.4°—111.2° F., and more. I distinguish in these cases three different directions, the "pyæmic," the "icteric," and the "nervous," corresponding to pyæmia, pernicious jaundice (acute yellow atrophy), and pernicious nervous catastrophes, devoid of anatomical basis. The nervous form is the less developed, the icteric the most pronounced, pyæmic the most complete. Rigor, jaundice, enlarged spleen are met with an intense fever, moderated by deceptive remissions.

In the cases which end fatally (without multiple centres of suppuration or jaundice) the disease runs its course like a very severe articular rheumatism. A descending direction may even have set in, but suspicious nervous symptoms appear. With them the temperature reaches the most extreme degrees in the briefest time, so that death occurs with hyperpyretic temperatures; whilst no anatomical

lesion of the brain can be discovered, only a very moderate degree of meningitis: *post-mortem* elevations of temperature may be met with.

XX.—Osteo-Myelitis.

In acute osteo-myelitis, which resembles typhoid fever in many respects, and has, therefore, been called "bone-typhus," the course of temperature coincides accidentally with some typhoid attacks. I observed six cases, of which five displayed a continuous course till the fatal termination. In three it lasted eight days, in one fourteen, the whole not a fortnight. One case died with a temperature of 40.7° C.=105.26° F., which rose after death to 41.1° C. =105.98° F. The fluctuations had been irregular, but trifling; the contrast striking between comparatively moderate temperature and the enormous frequency of the pulse.

XXI.—Parenchymatous Inflammation of the Kidneys.

Acute inflammation of the kidneys (Bright's disease) has very little regularity of temperature. Its course seems dependent on the rapidity, intensity, and circumstances of the attack. Its temperature is rather moderate, sometimes 39.5°—40° C.=103.1°—104° F. In cases which recover the gradual defervescence is by lysis, in fatal cases death occurs in a rise or in a fall of temperature. Chronic inflammations of the kidneys affect the temperature very little, and even in fatal cases terminal elevations of temperature are exceptional.

XXII.—Hepatitis.

Acute "parenchymatous" inflammation of the liver exhibits varieties whose temperature differs widely; but no common principle can be deduced from the paucity of the observed cases. In the form with malignant pernicious jaundice, either from phosphorus poisoning or not, the temperature is sometimes unaffected, even unto death. In yellow fever, according to Schmidtlein's *Deutsches Archiv. für Klinische Medicin*, iv. 50, the temperature is highest in the first few days, 40°—41° C.=104°—105.8° F., with slight evening exacerbations; from the fourth to the fifth day the temperature steadily falls down to normal, or even below; in fatal cases it rises again towards the end 2° C.=3.6° F., or more. In suppurative inflammation, with abscess of the liver, the temperature may follow the same course as in pyæmia and in chronic suppuration; repeated rigors, with great elevation of temperature, are observed in blennorrhœa of the gall-ducts and in abscess of the liver.

XXIII.—Lues.

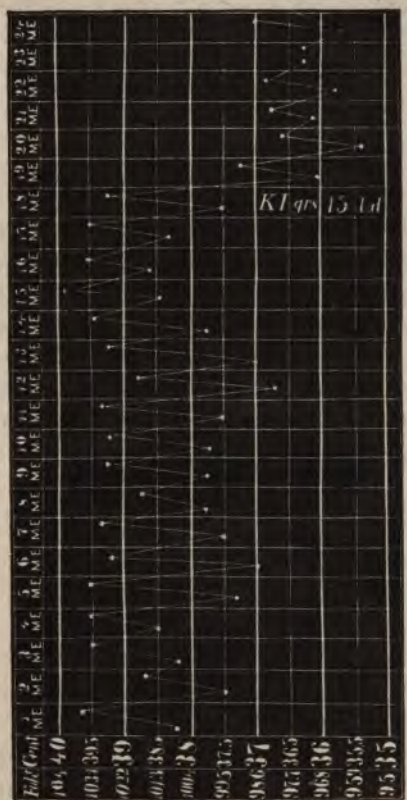
(Syn.: *Constitutional Syphilis.*)

Syphilitic symptoms may develop themselves without fever, but with certain of them fever is far more common than is generally believed. This fever is so characteristic that it is suspected by a single glance at the course of temperature as seen in Fig. 39.

In syphilitic cases elevated temperatures are most common at the time of the first extensive hyperæmic papular

or pustular eruptions; the fever may be very severe, with maxima at 41° C.=105.8° F.; its course is markedly remittent, with a daily downfall quite to normal. The

Fig. 39.



alternation of deep morning remissions and high evening exacerbations is tolerably regular; the duration of the fastigium is quite indefinite; the fever subsides by the exacerbations becoming less severe in the manner of the convalescence of typhoid fever.

In the acute syphilitic affections of the liver, brain, and bones, temperatures almost similar to the preceding are met. In the malignant form, so soon fatal, 40° C.=104° F. are met, with or without remissions, which are deceptive; the fever has no regular course nor order. (See Marasmus.)

XXIV.—Glanders and Farcy.

In the only case I know, where temperature was taken (at first the fourteenth day of the disease), it was of moderate severity, rose from the nineteenth day in zigzag; and never sank, from the twenty-fifth day forward, below 40° C. =104° F.; and in the last few days (fifth week) of the disease 41.3°—41.6° C.=106.34°—106.88° F. being obtained. No observation of the last twenty-four hours.

Mr. de Morgan reports, in the *British Medical Journal*, April, 1870, a case whose temperature was not very high, but rose at death, the twentieth day, to 40.2° C.=104.4° F. (Note of W. B. Woodman.)

XXV.—Acute Miliary Tuberculosis, Etc.

Acute miliary tuberculosis produces alterations of temperature generally proportionate to the abundance of the tubercular deposits. When the miliary tubercles are scanty and localized, or the patient is under the influence of previous diathesis, as advanced phthisis, cerebral disease, etc., his temperature is slightly affected, if at all, by the tuberculosis.

The course of temperature in miliary tuberculosis shapes itself like that of an incipient catarrh ending in hectic fever; of typhoid fever, or of intermittent fever; and these forms may succeed each other in a single case. The first is met in subacute cases. As regards temperature, it commences like in severe influenza; only the persistence of the fever excites suspicion. Gradually deep remissions, almost to a normal temperature, alternate with high evening exacerbations, rendering acute tuberculosis undistinguishable from non-tuberculous phthisis, even up to death; unless meningeal tubercles are developed, and the characteristic symptoms of basilar meningitis are manifest. In the second form, the temperature is more irregular and the remissions greater than in typhoid fever, from which the diagnosis is often impossible to the time of death. These cases are most rapidly fatal; should they escape, the fever assumes the hectic or the intermittent type, rarely the latter. In it, the course of the temperature of each fever-abscess (or local suppuration) may perfectly resemble that of an intermittent fever, even to a tertian or duplicated quotidian rhythm; yet, the afternoon attack, the lower height of temperature, and the deeper apyrexia (below normal), point to acute tuberculosis. In the further course the intermittent type is succeeded by a milder remittent which clears up any remaining uncertainty.

XXVI.—Acute Phthisis.

Acute phthisis may originate in a condition perfectly free from fever, upon which elevations of temperature supervene in zigzag with remissions and exacerbations of

increasing severity. Or it may closely follow the fever of bronchitis, pneumonia, etc.

In the further progress of the disease, the temperature follows a non-continuous course. The daily differences are as high or higher than 3° C.=5.4° F.; the daily maxima (sometimes two) approximate to or exceed 40°—41° C. =104°—105.8° F. The daily falls are abrupt, their minima descending to the normal point, or below. Even profound collapse is not rare. An alternation from day to day is sometimes displayed in the remissions, more so in the exacerbations. Intercurrently the remissions become less and the course becomes subcontinuous in an ascending type: complications, like pneumonia, may bring these modifications.

"The fever is often interrupted, also, by short (less often by longer) intervals of moderate fever, or of subfebrile, or even of normal temperature." It is rare to meet with a persistent subcontinuous course with considerable or moderate fever from the very beginning to the fatal end; but it is a common occurrence at the approach of death, for the temperature falls from its previous height, and the remissions become less distinct; unless (rarely) the temperature, which had previously fallen, rises afresh during the death-agony, even to hyperpyretic heights.

Sydney Ringer, "On the Temperature of the Body as a Means of Diagnosis in Phthisis and Tuberculosis" (1865), asserts that there is an elevation of temperature in all cases of tubercular deposit; Wunderlich says that there are intervals free from fever in some cases of phthisis; and that in some cases miliary tuberculosis does not affect the temperature at all. I certainly agree with Henri Roger when he says, "Si dans l'enfance, comme aux périodes plus avancées de la vie, les tubercules donnent quelquefois lieu à un accroissement de chaleur animale, ce

n'est point par eux-mêmes, mais par leurs effets consecutifs, par l'irritation locale que leur présence détermine dans les tissus. Lorsque cette inflammation n'existe pas, ou est devenue chronique, le thermomètre monte à peine au dessus du niveau ordinaire. Andral a constaté pareillement chez les adultes que la temperature reste normale dans la phthisie pulmonaire tant que la fièvre ne s'allume point" (*De la Temperature chez les Enfants*, Paris, 1844.) Hérard and V. Cornil assert that, without complications, there is no fever in the stage of deposit (*De la Phthisie Pulmonaire*, Paris, 1867). Finlayson also objects to Ringers' statement. He adopts the three types of Sir W. Jenner, the *insidious*, the *active febrile*, and the *adynamic* phthisis.

First type.—Morning temperatures normal, or under; evening's more or less high. Ex.:—A child has a temperature of 99.32° F. in the morning, and in the evening 101.53°—101.80° (in rectum). This equals the "insidious," and often "unexpectedly fatal type."

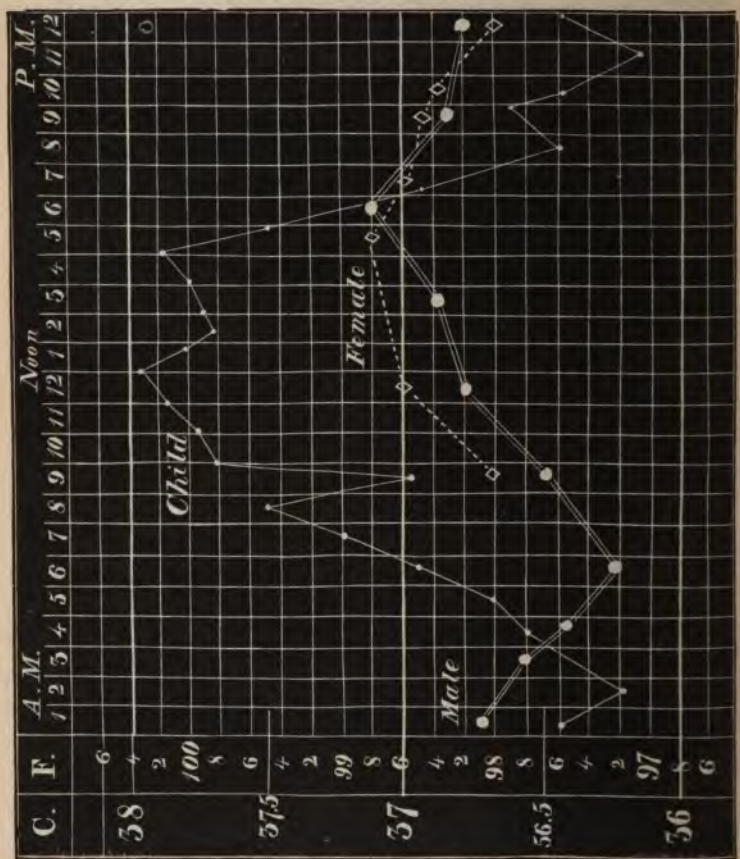
Second type.—The morning and evening exacerbations are both high, whilst there are evening exacerbations. Ex.:—A child has a morning temperature of 100.16° F., and an evening's of 101.57°—103.67° F., the "active febrile type."

Third type.—The morning and evening temperatures are both high, but there is a tendency to exacerbations at odd times. Ex.:—On one day the child has a morning temperature of 102° F., and in the evening of 102.33° F. On another day the morning and evening temperature may be respectively 102.6° and 104° F.; this characterizes the "adynamic type."

It is rather the "course" than the "height" of the temperature which must be consulted in phthisis. To that effect is subjoined the Fig. 40, which combines Fig.

layson's table of the variations of temperature during twenty-four hours in healthy children with Dr. Ogle's

Fig. 40



tables of temperatures in male and female adults. (Note of W. B. Woodman.)

XXVII.—Trichinosis.

Trichinosis exhibits no typical fever; but the course of temperature in it affords almost the only proof that a considerable elevation of the general temperature of the body may be brought about by purely local (though enormously multiplied) disturbances; this is true at least for the first period. But when the disease has lasted some time, and the deposits have reached a later stage, further mischiefs are developed by the implication of the brain, lungs, kidneys, and other organs in which there are no trichinæ; in these advanced cases it is no more possible to determine how much of the fever is due to the typical inflammation of the muscles, and how much to the cerebritis, nephritis, etc.

Observation shows that in spite of extensive muscular symptoms, and probably no inconsiderable localization of trichinæ, fever may be absent or slight; the same when the muscles are first attacked, but in the further course the temperature grows to 40°—41° C.=104°—105.8° F., with remissions to normal temperature or beneath it, so that every day re-establishes its own equilibrium. These high temperatures do not last long, even in fatal cases; this march cannot be confounded with that of typhoid fever or articular rheumatism, but with acute tuberculosis and internal suppurations. But when the fever is moderate it has no character.

XXVIII.—Malarious Diseases.

The intermittent fever is the only form of malarious infection whose course of temperature is known. There is

no opportunity in our country of making any observations on the remittent. We distinguish in the intermittent fever the course of the temperature in the isolated paroxysms, and the course during the whole disease.

The separate "paroxysms" are each characterized by a sudden rise of temperature (generally with rigors and "cold shivers") to a height of extreme fever and an equally rapid return to the normal, or below it. The rise is the first symptom. It may continue slow for a few hours, up to 38.5°—39° C.=101.3°—102.2° F. With the rigor it starts up in one hour to 41°—41.5° C.=105.8°—106.7° F. Meanwhile, the stage of dry heat (hot stage) may have set in, and the rise go on to the acme of the paroxysm, forming a summit-pointed or slightly bifid.

The "maximum" is reached in the stage of dry heat, or when partial sweating appears; it only lasts a few minutes. With the sweating (moist stage), the temperature descends slowly for the first hour or so, then fluctuates, then falls decidedly without any fresh rise. However steady may be this fall, it is accomplished by an alternation of horizontal progressions and partial descents, some at the rate of one-tenth, some at that of one-half of a degree per hour, whose downward lines form "terraces," which in four hours bring the temperature back to 40° C.=104° F. Then it sinks somewhat more rapidly, requiring, however, ten or twelve hours more to regain the normal point, 37° C.=98.6° F.

During the "apyrexia" the temperature may fall below normal; but if it lasts more than a day, there is a slight evening exacerbation. Not infrequently the use of quinine suppresses the subjective symptoms, but leaves the elevation of temperature almost equal to that of a complete paroxysm. Then rise and fall are compressed into *less time* than when there is rigor. This behavior of the

temperature in the paroxysm is so characteristic of intermittent fever (ague, etc.) that it renders its diagnosis tolerably certain. There are very few diseases in which the temperature rises so rapidly from the normal to 41°—41.5° C.=105.8°—106.7° F., and returns with equal swiftness to the normal point. The study of the temperature of "a single paroxysm" differentiates intermittent from typhus, meningitis, and cholera, at least.

The paroxysms of intermittent fever succeed one another and have several rhythms. The most normal is that in which they are repeated after about forty-four or forty-six hours, "tertiana anteponens." Thermometry alone is often able to reveal the fact that the apparently simple quotidian, tertian, or quartan is duplicated; and that either stronger paroxysms alternate with weaker ones in the "apparently quotidian rhythm," or that between the separate paroxysms, which are completely developed in all their symptoms, there are interposed attacks which announce themselves only by an elevated temperature.

In a similar manner, complete recovery from intermittent fever can only be guaranteed by the thermometer. It teaches us that the fever does not generally terminate with a well-defined paroxysm; but that fresh attacks may succeed, which consist only in a rise of temperature that the thermometer alone can detect, and may give place to new perfectly developed paroxysms, if the treatment is too early discontinued.

XXIX.—The Temperature in Cholera.

Observations of temperature in cholera are difficult, since taken in different regions they do not run a parallel

course. In the axilla they demand great caution; the mercury rising there very slowly, particularly in the cold stage, and thence not affording a correct standard of the temperature of the blood. However, they are valuable by representing the temperature of the skin, and become once more trustworthy in the period of reaction. But the extent to which the skin is cooled is better indicated at the hands or feet. In the algide stage the mouth gives hardly any approximation to the general temperature, only to that of the expired air. The rectum and vagina offer the only temperature approximating that of the blood; but the action of the bowels often prevents the use of the former, and womanly delicacy the latter; besides, diphtheritic affections of the vagina supervene in cholera. But the contrasts between the thermometric results obtained in these various parts afford valuable hints for prognosis. Thus a great difference between the axillary, rectal, and vaginal temperatures is unfavorable, but a rise of the temperature in the mouth, with a fall in the vagina, promises well. The temperature presents the same signs in sporadic as in epidemic cholera, only less marked.

When patients from other diseases are seized with cholera their temperature begins to fall before any other symptom appears; which demonstrates that the fall of temperature in cholera is not primarily the result of the evacuations. (Perhaps it does result from the increased flow into the intestinal canal, just as a fall of temperature succeeds internal hæmorrhages.—W. B. Woodman.)

In the "stage of evacuations" of slight cases, which do not become asphyxiated, the axillary, vaginal, and rectal temperatures are normal (or the vaginal a little raised). With indications of asphyxia the temperatures diverge; vaginal higher, and axillary somewhat lower than normal. In the algide form (that will recover), the temperature of

internal parts is moderate; rarely high, 39.6° C.=103.28° F., and seldom normal or below.

In "death by asphyxia" the vaginal and rectal temperatures reach higher, 40°, even 42.4° C.=104°—108.32° F. Profuse and violent alvine discharges are indicated by a fall. When the temperature rises (even only relatively to the other symptoms), it announces the cessation of the alvine discharges. A rapid and considerable fall and a rapid and considerable rise of temperature are warnings of death; on the contrary, the less the temperature fluctuates the more probability of recovery. During the algide stage, the temperature of the skin falls indeed very low, 35° C.=95° F. The axillary fluctuates less than the internal. Rapid changes of surface temperature are threatening. A low temperature slowly and steadily rising with only slight fluctuations which hardly exceed the normal, is of good omen. Lowest of all may be the temperature under the tongue; in asphyxia it seldom exceeds 31° C.=87.8° F.; even cases at 26° C.=78.8° F. have recovered; none below.

In the post-choleraic, or reaction period, the temperature returns from its abnormal condition to its norme again, yet moderately febrile elevations are not dangerous, but must awake the attention; higher elevations of temperature are sure signs of complications and local affections, which narrow the prospect of recovery. Very high temperatures are induced by parotitis, erysipelas, and more rarely by atypical pneumonia. Roseola and other exanthems do not always induce a rise of temperature. A normal or quasi-normal temperature in the post-choleraic stage is no guaranty of recovery.

In a typhoidal reaction the temperature may be normal or a little higher, or rise above, and take a remittent course; these are stormy cases; if they do not end by

death at once, they are much protracted. Parenchymatous nephritis is one of the sequels in both forms of reaction.

The most unfavorable omen in the post-choleraic period is when a normal or elevated temperature suddenly sinks below normal. A considerable loss of surface-warmth indicates great danger.

In many cases the temperature of the body falls after death; in others (especially with those previously high), it rises for some minutes or half an hour after death.

XXX.—Injuries of the Cervical Portion of the Spinal Cord.

Since the experiments of Chossat and B. Brodie, 1837, on "the rise of temperature in cases of injury to the spinal marrow," other observations have confirmed the doctrine that "injuries to the cervical portion of the spinal cord produce enormous elevations of temperature;" by Billroth, a rise to 42.2° C.=107.95° F.; by Quincke, two cases with temperature at 43.4°—43.6° C.=110.12° F. —110.48° F.; by Weber, in London (*Trans. of the Medical Society*, vol. i., 1868), two cases, one with temperature at 44° C.=111.2° F., the other with a *post-mortem* temperature of 43.3° C.=109.94° F.; by Fisher (*Centralblatt*, 1869, p. 259), a rise to 42.9° C.=109.22°. F. On the other hand, the same Fisher has observed two cases of injuries of the cervical portion of the spinal cord with a diminution of temperature, in one case, to 34° C.=93.2° F. in the rectum, and in the other to 30.2° C.=86.36° F. in the axilla.

XXXI.—Neuroses.

Uncomplicated neuroses, manifested by psychical, sensitive, or motor disorders, recent or chronic, exhibit no appreciable alteration of temperature. The following are exceptions: Intermittent neuroses, developed under malarial influences, may present elevations of temperature; in hysterical neuroses excessive elevations of temperature may happen, as any other possible symptom, without apparent motive; in the vaso-motor affections, yet little understood, there are alterations of temperature. A rather subnormal temperature is observed in many insane persons, in others a moderate subfebrile. Inanition and exposure raise sometimes enormously the temperature of the insane. Very great elevations of temperature occur in paralytic lunatics (Westfall, *Archiv. für Psychiatrie*, i. 337). An extraordinary temperature is attained in "tetanus;" 43° C.=109.4° F., 44° C.=111.2° F., even once 44.75° C.=112.55° F., which generally increase a few tenths *post-mortem;* in the tissue changes of the brain and of the upper part of the spinal cord as well.

It seems that any considerable elevation of temperature in neuroses (without any accessory cause), affords an unfavorable prognosis.

XXXII.—Chronic Disorders of the Blood, of the Tissues, and of the Secretions.

Many chronic changes affecting "the composition of the blood and the formation of tissues and secretions" may influence the course of the temperature, as shown by the following empirical discoveries: an abnormally low tem-

perature is commonly met in "inanition," particularly during the last days of life; the more so, since it is a sequel and a concomitant to many chronic diseases, by which the course of the temperature is lowered, as by marasmus, deprivation of food, muscular exertions, perspirations, vomitings, diarrhœa, loss of blood, etc. This is especially noticeable when the fatal end is nigh. The decrease of temperature in emaciated children is very great just before death, especially in the subjects of syphilitic marasmus at the breast. In one such case, the temperature began to be subnormal six days before death, and gradually sank to 25° C.=77° F. in the rectum. In another case of common atrophia infantum it was only 28.6° C.=83.48° F. The temperature (at least in the axilla) is much diminished in sclerema of new-born children. The average of twenty-nine observations, by H. Roger, was 31° C.=87.8° F.; and of seven, less than 26° C.=78.8° F.

It has been thought that thermometry could afford an aid to distinguish tubercular from non-tubercular phthisis. This hope is for the most part illusory. The existence of cheesy deposits cannot be recognized by thermometry. To distinguish the development of phthisis from caseous pneumonia, the observations must have been commenced when the latter was recent, and must be continued through the period of transition. The presence of sparse or tolerably numerous tubercle-granules in the lungs, pleura, spleen, or liver, is devoid of action on the temperature. It is only when numerous and closely studded miliary tubercles are rapidly deposited that the temperature of the patient is affected by them. But the same modification of temperature may be brought about by protracted pneumonia, etc. And copious deposits of miliary tubercles in the peritoneum, also granular meningitis, may induce the same course as the fever in phthisis.

Cancer rarely elevates the temperature, but rather maintains it in the normal regions. In a case of medullary cancer of the liver the temperatures of the last six days of life were:—

1st morning, 99.5° F.; evening, 100.0° F. 2d morning, 99.5° F.; evening, 98.4° F. 3d morning, 99.5° F.; evening, 99.5° F. 4th morning, 98.2° F.; evening, 99.0°F. 5th morning, 97.6° F.; evening, 99.4° F. 6th morning, 98.9° F.; evening, died.

(Observations of carcinoma of the liver, uterus, and breast, before marasmus set in, show slight elevations or none, never above 38.4° C.=101° F., unless from complications; I have often found subnormal temperatures with rapid pulse in advanced cancer.—W. B. Woodman.)

Chronic cases of heart disease exhibit elevations of temperature when acute attacks supervene.

In diabetes mellitus (glycosuria) high temperature is quite exceptional, and subnormal not rare.

Jaundice (the pernicious kind excepted) does not elevate the temperature. Dropsy has low as well as high temperatures.

Temperature in chronic diseases shows a variety of courses. It is much affected by external influences. Its daily fluctuations are rather considerable and disorderly. Its exacerbations begin earlier, and approximate febrile heats. It moves upon a higher plane as regards the daily average than it does in health. The morning temperatures may be almost normal and the evening ones rise 4°—6° C.=7.2°—10.8° F., "resembling intermittent." Sometimes two exacerbations a day, one more severe than the other (like a duplex quotidian), are separated by two normal remissions; sometimes the single daily exacerbation is stronger one day, weaker the next, or the exacerbation is omitted every alternate day (tertian rhythms), or at

still wider intervals (quartan and sextan rhythms). This course is quite common in chronic suppurations and phthisical conditions, and in some undemonstrable inward affections terminating later in death or protracted recovery. It is incontestable that quinine, and arsenic in a higher degree, have a beneficial influence upon these chronic fevers.

Chronic fever often assumes the "remittent" type; remissions early, exacerbations from noon to late, at 39.5°—40° C.=103.1°—104° F. This course slides into some other type more dangerous or less severe. It is found in chronic suppurations, phthisical affections, and large fluid exudations.

Chronic fever may assume, too, a "continuous" type, high, indeed very high. Such fever burns too much to last long; therefore it soon merges into other types, or pulls the patient down. It is met with in intercurrent relapses, complications, and the conclusion of fatal diseases.

"Intercurrent relapse" may occur more than once in any form of chronic fever; oftener after the temperature has been very high, seldom when it was moderate. These almost critical downfalls resemble collapse, except that they do not descend so rapidly nor so low, behaving more like defervescence. They are sometimes favorable, oftener deceptive (pseudo-crisis). These great irregularities displayed in chronic diseases portend no good; the extreme elevations are dangerous, the great depressions are ominous: the more abrupt the change, the greater the danger.

Toward "the fatal close" of chronic diseases and in the death-agony the temperature differs, as the immediate causes of death differ.

As a general rule the temperature, in chronic diseases, oftener falls than rises before death. It falls relatively to the former temperature, or absolutely as in marasmus of

children, insane and syphilitic patients. But in other cases, the temperature, which had before been almost normal, begins to rise a short time before death, at first slowly and moderately, and in the latter period rapidly: in twelve to thirty hours reaching 40°—41° C.=104°—105.8° F.; "terminal fever."

CHAPTER XIII.

ON THE INFLUENCE OF ALTERATIONS OF TEMPERATURE UPON THE SYSTEM.

CONSIDERABLE change in temperature must produce corresponding effects on the human system and its separate parts, functions, secretions, and nutrition; since physiology has demonstrated experimentally that alterations of temperature act upon the irritability and sensibility of muscles and nerves; and E. Cyon has shown "the influence of changes of temperature on the number, duration, and strength of the beats of the heart." In the latter experiments it was noticed that all hearts did not behave exactly alike under similar circumstances; results which must prepare us to find an individual influence modifying the action of temperature in pathological cases. Some of the effects of altered temperature on the human system may be thus summarized:—

"On the general nervous system." However susceptible the nervous system is to manifold influences in different individuals, this much is certain: The brain functions may continue in all their integrity at any degree of temperature compatible with life; at least so long as superexertions are not exacted from them. In the hyperpyretic temperatures, as in death-agony, there is often a strangeness and confusion of modality, but besides the temperature there are also numerous and extensive lesions of organs to account for it.

"On the movements of the heart." There are certain relations between the pulse and the temperature. With

high febrile temperatures we no longer meet with quiet contractions of the heart, but quite otherwise. The latter become more frequent, but insufficient and irregular. However, it is not certain that the cardiac contractions are determined by the excess of temperature, but more likely that changes in the pulse have slightly preceded the alterations of temperature.

"On the fulness of the capillaries," since their mode of activity reacts upon the giving off of warmth, their relation to temperature is complex, and not yet fully understood.

"On the frequency of the respirations;" of which, however, the same may be said as about the heart's contraction.

"On the tongue;" although extreme dryness (thirst) is often observed with normal temperature, and without any local affection.

"On the digestive faculty;" although by the frequency of the interference of gastric catarrh in almost all diseases, the direct action of morbid temperatures on the digestive functions is much complicated.

"On the integrity of the functions of the muscles;" which may, at the same time, be affected by other causes.

"On the secretions," especially of the urine; although the relations of this function to the changes of temperature are far from determined.

"On the composition of the blood," particularly in relation to the diminution of the red corpuscles, which, however, may take place by other processes.

"On the tendency to extravasations and transudations and to aggregation of deposits," all possible effects of the most widely differing factors, besides abnormal temperatures.

"On processes of parenchymic destruction" (acute fatty degenerations), although they may occur without any

considerable alteration of temperature, and in poisoning by phosphorus.

"On the general nutrition of the body," by diminishing or arresting it. Although consumption is not produced by fever alone; but the shares in it of the other processes and of temperature cannot be calculated.

From a very large number of separate observations we arrived at the following conclusions:—

When "the changes of temperature are moderate," either in rising or falling, nothing supervening in the system need be attributed to this modification of temperature, which could have happened without it. Yet the subjective feelings, the general turgescence, the faculties of digestion, micturition, thinking, etc., are affected by this moderate change of temperature; whose effect increases if the system is called at the same time to make any considerable effort.

When "the temperature rises abruptly" from normal, or nearly normal, to a great height, it is common to meet with nervous and functional disorders; yet in some cases these disorders are absent, and nobody suspects what is going on but the clinical thermometrician. It is remarkable enough in these cases that delirium is rare; headache, absence of mind, fainting, and even sopor are common.

"Considerable elevations of temperature," when alternated with large daily remissions, may last for some time without being accompanied by phenomena evidently dependent on the anomaly of temperature. The functional disorders of this period may be due, less to the height of the exacerbation, than to the primary and secondary causes of illness. However, this kind of fever impoverishes the blood, alters the secretions, diminishes the nutrition, less, as it appears, from the intensity, than from the *duration* of the fever.

"In subcontinuous and continuous elevations of temperature, of considerable amount," there are so many other serious conditions present that it would be unjustifiable to attribute functional anomalies and consecutive disorders of tissues to the exclusive action of the temperature.

"There is a definite relation between the temperature and the event of death," inasmuch as the continuance of life is clearly incompatible with certain heights of temperature. However, in this respect relapsing fever has demonstrated that the limits of bearable temperature (compatible with life) must be extended further than it was once believed.

"With a fall of temperature from high degrees to normal or below it," we find remarkable anomalies of function which may lead to recovery. In typhus the delirium often lasts some days after the fever; and even in typhoid fever the greatest disturbance of the brain may coincide with the descending temperature; in pneumonia, the delirium, etc., occur oftener after the maximum has been attained, or even after the fall reached the normal point. The same is true of any other kind of disease. But just as frequently abrupt falls of temperature take place without affecting in the least the functions of the brain or other organs.

"In subnormal temperatures" there is, indeed, generally an influence on the turgescence of the surface of the body (for instance, the washerwoman's hand in cholera), impression not to be overlooked in the aspect of the face. Other parts of the body, also, may be disturbed in their functions by a great downfall of temperature; but such symptoms are so intermixed with other phenomena that it would not be philosophical to attribute all the modifications to the decrease of temperature.

PART THE SECOND.

SUGGESTIONS

ON

THERMOMETRY

AND

Human Temperature.

BY

EDWARD SEGUIN, M.D.

PUBLICATIONS BY THE SAME AUTHOR.

1839. *Résumé de ce que nous avons fait pendant quatorze mois.* Esquirol et Seguin. Paris.

1839. *Conseils à M. O....., sur l'éducation de son enfant idiot.* Paris.

1842. *Théorie et pratique de l'éducation des idiots.* Leçons aux jeunes idiots de l'hospice des incurables. 1re partie.

1843. Ditto. Seconde partie.

1843. *Hygiène et éducation des idiots.* Extrait des annales d'hygiène et de medecine légale. Paris. J. B. Bailliere.

1846. *Images graduées à l'usage des enfants arriérés et idiots.* Paris. Aubert.

1846. *Traitement moral, hygiène, et éducation des idiots*, etc. 1 vol. 734 pages. Paris. J. B. Bailliere.

1847. *I. R. Pereire, premier instituteur des sourds et muets en France.* Sa méthode pour faire parler les s.-muets. 1 vol. 355 pages. Paris. J. B. Bailliere.

1852. *Historical Notice of the Origin and Progress of the Treatment of Idiots.* Cleveland, Ohio.

1864. *Idiocy, its Diagnosis and Treatment by the Physiological Method.* Albany, N. Y.

1866. *Idiocy and its Treatment by the Physiological Method.* 1 vol. 457 pages. William Wood & Co., Publishers, 27 Great Jones street, New York.

1870. *New Facts and Remarks Concerning Idiocy.* W. Wood & Co., New York.

1870–71. *Fasciculi, read before the New York Library and Journal Association:*

No. 1. *On Surface Thermometers.*

No. 2. *On the Use of the Instruments of Positive Diagnosis by Life Insurance Companies.*

No. 3. *On Establishing the Scale of Human Temperature upon the Basis of the Normal Human Health*, 98.6° F.=37° C., *henceforth Zero-health.*

1871. *New Tables of Temperature, Vital Signs and Septenaries for Private Practice*, by the 100 or 1,000, from W. Wood & Co.

1871. *Prescription and Clinic Record.* The most simple and scientific pocket-book for a physician. One copy, 50 cents, three copies for $1; at W. Wood & Co.'s, publishers, 27 Great Jones street, N. Y.

TEMPERATURE.

"Rien de ce qui peut agrandir et perfectionner les sens de l'homme ne doit être pris en légère considération."—BIOT.

WUNDERLICH says in his preface; *Theoretical questions as to human temperature and kindred subjects must not be overlooked, and well deserve to be explored.* This protest against the exclusive worship of the *faits accomplis*, written on the front page of a book entirely consecrated to experience, sets him on a different level from the "practical men" who excommunicate ideas without thinking what would the world be, even in the most common affairs of life, without the ideas of only the last ten years. Wunderlich knew that nothing is nearer the status of fact than a germinating idea, even than the facts of to-day themselves. For no sooner is "a fact a fact," than an idea has already crept on to alter it and create its substitute; so that there is really and substantially more practicality and positivism in the idea of to-day, which will be the fact of to-morrow, than the fact of to-day, which to-morrow will be dross.

Happily, that wish of this most practical physician had long been the occupation of my leisure hours; and now that I have accomplished with devotion—if not with sufficient ability—the task of abridging his work to popularize his ideas, I return to my own studies. Thermometry is the question of the present hour; towards it all foreseeing eyes are turned. It is irrevocably wedded to medicine by its force of prognosis and diagnosis. By the mathematics of its data, and the positivism of its method of observation, it has already discovered the normal point of human health,

some laws of general pathology, and not a few of special diseases. Beyond this, it has identified physiology with the other physical sciences, by rendering mathematically demonstrable the disengagement of heat by muscular movement, the influence of the nervous system on the production of warmth, and the convertibility of human heat into physical and intellectual activity.

This and more has been done in a few years, by a few men, with instruments made for another kind of work. But who knows what medical (human, must I say?) thermometry could do, when the simplicity of its procedure, the adaptability of its instruments, the number of its devotees will permit its application, not only to the treatment, but to the prevention of disease, and especially to the high supervision of the training of youth, in reference to the dosing of air, moisture, heat, light, food, exercise, studies, in the sickly conditions of the growing stage. Then we shall begin to understand that, for physicians, thermometry is not only knowledge, but social power.

But it is only very recently that thermometry has become the generally acknowledged means of diagnosis we know it to be. De Haen could condole with his townsman, Avenburgger, upon the indifference or malignancy* of their confrères in regard to scientific improvement. Yet the discoveries of these never too much to be honored men stand to-day for nine-tenths of diagnosis, in lieu of the old instruments, conjecture and authority. Percussion and Auscultation occupy the highest place in Physical Diagnosis, just as Thermometry will in Positive Diagnosis: though few men live to rest their heads under the tree sprung from their imagination; no seeds grow so surely as those of the mind. Let us sow.

---

* See Avenburgger on Percussion, etc., in *Præfacio.*

Thirty years ago "Physical Diagnosis" had no name; now its teaching fills volumes. To-day the name of "Positive Diagnosis" is almost unknown, yet soon it will grow out of the parent stock, by a process of gemmation (budding), natural or artificial, into organic life, a process becoming frequent in science. It would be difficult to conceive what the practice of medicine *would be* to-day without Auscultation, Percussion, Thermometry, and the host of other means of physical and positive investigation; but it would be more difficult yet to realize what it *will be* after thirty years of close adherence to the laws of observation, of education of the medical senses, of training in the manœuvres of the instruments which give more delicacy and extension (reach) to the operations of our senses —the stethoscope, ophthalmoscope, specula, etc.—instruments of "physical diagnosis"—and in the handling of those which perceive and report mathematically the phenomena which our senses cannot reach—microscopes, thermometers, æsthesiometers, sphygmographs, etc.—instruments of "positive diagnosis." But we can already affirm that then physicians will be nearer physicists and farther from metaphysicians than now, and that physic will have completely reclaimed its place among the natural sciences.

The world has a critical eye upon the medical profession for that.

Of all recent discoveries, none will be so potent to give medicine a place among the positive sciences as its adoption of thermometry.

But thermometry did not begin with Sanctorius's instrument, nor can it be limited to it.

The mathematical precision of the mercury must not make us distrust and dismiss the "Hand," reporter of heat and of other accessory qualities besides; rather should it stimulate our ambition to perfect this natural thermom-

eter; so that it could in some respects complete, in others control, the results obtained by the mechanical one.

It is a cause of amazement, to me at least, that among the solid things taught before and during the progress of the study of physic there is no course of "training of the senses" as instruments of clinical observation: so much nurture bestowed upon the science; so little upon the art of medicine.

Restricting this vast subject to the point at issue, the training of the "sense of tact" concentrated in the hand, it must be the object of an early, refined, and life-long culture.

HAND-THERMOMETER.

The hand is a thermometer that we cannot help carrying with us. It gives—besides an idea of the temperature rendered more and more accurate by education—a knowledge of the concomitant properties of the parts under exploration, as tension, dryness, etc. It does not give a mathematical account of the temperature; but by simple "apposition," slight, deep, or profound and methodical pressures, it can make us appreciate more difference in the pyrogenic conditions of the cutaneous, infra-cutaneous, and deeper regions, than any other mode of exploration, even the simultaneous application of the fever and surface thermometers. Moreover, the hand is the instrument of a sense—the tact—which improves by use, rarely loses its virtue by accident, and in many circumstances can be, and is substituted for the other senses in observation: for the sight, so early and easily impared by use, excesses, even hereditary tendencies; and for the audition, not so often incapacitated for clinical purposes by accidents or diseases like scarlet, typhoid, and other fevers, and not so soon, but as surely by age. The necessity of this substitution of one sense for another is particularly felt by the young physi-

cians who, in their eagerness to study, have contracted one of these contagious or epidemic diseases which blunt the powers of perception of the ear, eye, smell, taste, singly or collectively. These men, more numerous than it is supposed, and intellectually above the average, would have to quit the profession if they could not substitute the perceptions of the tact for those of the other senses in diagnosis.

Therefore, to urge the necessity of the medical training of the hand is equivalent to advocating the addition of several instruments to ours, particularly of a thermometer.

EDUCATION OF THE MEDICAL SENSES.

The time is not far distant when the instructors of youth, instead of considering the perspicuity of the medical senses as a personal attribute, will educate them as normal faculties, which must be brought in physicians to the highest point of efficiency; whose object, far from being the elevation of a few favorites of transient fame, will be to educate plain and reliable practitioners. Then—that is to say, soon—will be organized courses of training of the Ear, to hear and listen; of the Eye, to see, look, discriminate, or scrutinize, to embrace totalities or to concentrate on details, etc.; of the Smell, to detect odors, smells, effluvia—of which there are too many in hospitals—and to classify them, as the most subtle and reliable of the external elements of prognosis; of the Tact, to enter into communication, by every nervous fibrilla peeping behind the pores, with the tangible properties of tissues, superficial and subjacent, to warn the mind against hasty judgments, to correct erroneous impressions of the other senses, and, above all, to measure life itself by its first and last expression, the evolution of caloric.

However well educated the hand may be, it is well understood that it can only give physical, not positive ac-

counts of its impressions: positive records of temperature being the exclusive function of automatic instruments.

To elucidate the questions of pure scientific interest we have the thermo-electric apparatus of Becquerel, Dutrochet, Helmholtz, Lombard, etc.; for medical purposes we have the mercurial thermometers. The latter—of which alone I shall speak—are yet far from that point of adaptability required by the lowest mechanic from his ordinary instruments of labor. Their various scales in different countries raise a clangor of discordance wherever an attempt is made to accord the results of their operations by the recital of the litanies of their equivalents (as in the first part of this volume). Their registration has no prominent point corresponding to a prominent point in human temperature; they can measure the temperature of cavities but they cannot that of surfaces. In fact we have already a science—a section of diagnosis—called *Medical Thermometry*, but we have not yet a *medical thermometer.*

And why? Because modern physicians, instead of making their own instruments, as did Sanctorius, have borrowed those of the physicists.

Exceptionally, one is pleased to recall the useful modification of Dr. Aitken, so ingeniously executed by L. Casella (a self-register), by which the temperature can be read at any distance from the patient. There is no doubt that this *self-registering thermometer* permits a nurse to take the temperature in the absence of the physician; and moreover has saved the lives of many of our most valuable men, by obviating the necessity of imbibing the effluvia of contagious diseases when reading the temperature in close contact with the sick. I can mention, also, from private correspondence, the attempts at constructing a *Surface Thermometer:* "efforts which have met with warm commendations from many members of the medical pro-

fession" (L. Casella, London, July 10, 1871). But the beneficent addition of Dr. Aitken is the only successful improvement made to thermometers by medical men, and does not render the discrepant thermometers more "medical." The efforts to invent a "surface thermometer" by Casella, and I have no doubt others, in view of its adaptation to clinical purposes, have remained fruitless so far.

Under these circumstances, physicians, with borrowed tools and an indomitable perseverance, began (1835–55) to extract the elements, principles, and laws of human temperature from the chaos of figures juxtaposed as equivalents from Fahrenheit, Reaumur, and Centigrade.

As on a battle-field, many lives have been spent since five and twenty years in taking temperatures, reducing one scale into another, writing figures, drawing curves and diagrams, summing up the products of the most intricate traces into general laws of thermo-physiology, and special laws of thermo-pathology, which will pass, like so many victories, to posterity under the name of General Wunderlich and others, who evolved the truth from the million of observations of the thousand nameless observers.

This was good to begin with, in the heroic times of thermometry. But since this mode of diagnosis has become popular, we shall have to simplify its instruments and method of recording observations, to lower it to the vulgar heroism—heroism yet, after all—of the daily laborers in physic, who are willing to use the new method of diagnosis, provided it is made as expeditious as it already is effective. Let us, therefore, admire the monuments of the Titanic period of thermometry, like the Treatise of Wunderlich "On the Temperature in Disease," etc.; but entertain no illusion as to the fate of medical thermometry itself. Thus presented with its unavoidable escort of millions of facts, and with diagrams whose curves could compete

with the waves of the ocean; and moreover represented by instruments which have no concordance among themselves, no relation whatever to human temperature, and no adaptability to the various parts of the surface of the body, whose temperature is so often the thing looked for, as in intermittent fever, for instance, where men like Wunderlich are reduced to guess about the difference of surface-temperature of the trunk and of the extremities; the present mode of taking and recording clinical thermometry makes upon the mind of a practitioner, first, an impression of awe, second, one of disappointment, which too often is the last one.

Such being the principal causes why medical thermometry has been and would remain a sort of arcanum among the hospital chiefs of service, who can command the labor of a large and intelligent staff, instead of extending the benefits accruing from its immense diagnostic and prognostic value to the whole profession, thence to the sufferers at large; I, for one, conceived that it would be of great honor to my profession, and of great benefit to my race, to render medical thermometry so easy that its use could become general, and could be extended to the solution of social and economical problems far more important than those of individual disease and recovery.

The simplification would bear upon the instruments of observation, and upon the method of recording observations, and extend to new and important objects of general interest.

"*Medical Thermometers.*"—Thermometers cannot be called *medical* so long as they do not meet the requirements of the profession. For one of these requirements we want to take the general and local temperature, therefore we must have a thermometer adaptable to cavities, and another to surfaces; if we need more than one ther-

mometer, let us have as many as we want—have not surgeons more than one knife?

Again: For another requirement, can thermometers really be called *medical* whose scale is not based upon the *thermal status of man?* In other words, what has the freezing-point of mercury, or the melting-point of ice, to do with our own caloricity? The second proposition enunciates the absurdity of the present situation.

The first thing to be done was to take up the question where Brechet had left it. (See *Mémoires de l'Académie des Sciences*, Paris, 1835–37, and New York *Medical Record*, Jan., 1867.) He had settled the basis of human temperature; I sought to conform thermometric observation to his discovery, by making the centre-point of health the pivot of graduation of the medical (human) thermometer.

Thermo-physiology has found the temperature of a healthy man to be at the axilla (a convenient and decent place, too) 98.6° F.,=37° C., with due regard to the oscillations integral to life itself. Practically this is the 0° temperature on the "medical thermometer," the NORME of *Medical Thermometry*.

Objections may be raised against taking this *norme* as the standard measure of medical thermometry on account of the diurnal variations, the idosyncrasies, or the differences between the results obtained by the fever thermometer in several cavities, and by the surface thermometer at distant points of the periphery; but they have less weight than those raised against taking the pulse at the wrist as the standard measure of the general circulation.

The only possible objection to this standard would be the eventuality of a future displacement of the thermal point of health.

This objection is serious, but not formidable. Indeed,

such a displacement has already taken place, at least theoretically; since, in 1835, Brechet announced it to be 36.9° C.=98.5° F.; and in 1871 we accept, on the authority of Wunderlich, 98.6° F.=37° C. as the basis of medical thermometry. (Are calendars less useful since their errors have been corrected?) Now, supposing the German calculation to be proved incorrect in its turn, what of it? The error could have come in two ways. Either Wunderlich, whom we trusted, did err, and his calculations in regard to the mean temperature of the human body and his conclusions would be quashed (as were those of the Julian calendar); or the thermal conditions of man would have undergone some alteration which would have displaced our mean temperature lower or higher than the norme of Wunderlich, 98.6° F.=37° C. If such possible alteration, ever so insensible in its march, should happen, the discrepancy between nature and the standard measure would soon be detected. A new standard measure would be established, by transferring the norme—*zero* health—lower or higher on the thermal scale; and eventually, by repeating this transference, to meet the changes of human temperature in the course of ages.

These successive normes of human temperature would stand, like the pylones of Egyptian hydrometry, instead of impediments to progress—as the landmarks of the gradual calorification or decalorification of our race—a series of physiological monuments, unequalled by any other discovery for its importance upon the "Natural History of Man."

There is much more to be said on Physiological Thermometry, but I make haste to contract this cursory exposition of the generalities of the subject, to concentrate the attention upon the present engrossing topic, "thermometry rendered accessible to any conscientious physician, and

through him to mothers and medical attendants." For it is of no use to preach thermometry to the great mass of practitioners, whose time is mortgaged for bread to their families and charity to the needy, if, to apply the instruments, read, understand, and transfer their results from arithmetical scales on charts, to draw traces, etc., exacts an expenditure of hours to be found nowhere in their twenty-four. Therefore the question of taking, and particularly of registering the temperature *in no time* is integral to that of simplifying the instrument itself. But we can only expose one idea at a time, and the first in order is that of

THE MEDICAL FEVER THERMOMETER.

In the faith that *anything good must be possible*, I have caused a *meter of human heat* to be made,* which is neither Fahrenheit's, Reamur's, nor Celsius' instrument, but is founded upon the great discovery of Brechet: let it be called by its fundamental division and principal destination, *The Medical Thermometer*. Its zero (0) temperature corresponds to the health-point of the human body; thence its degrees (Centigrade) run up for fever, and down for depression of vitality; its minor divisions are to the fifth of a degree, easily divisible by sight into halves or thirds, $=\frac{1}{10}°-\frac{1}{15}°$ C.

To use this new fever-thermometer, it may be, like the old ones, inserted in the axilla, in the mouth, between the thighs or fingers; or for special reasons, in the vagina

* It has been the fortune of my instruments of medical thermometry—whatever may otherwise be their fate—to have been executed by Geo. Tiemann & Co., the surgical instrument manufacturer of this city; who brought into their realization the utmost ingenuity, perseverance, and enthusiasm. I must acknowledge, besides my gratitude, that in my estimation Geo. Tiemann & Co. stand, relatively to this new system of medical thermometry, in a position somewhat akin to that of L. Casella in regard to the self-registering thermometer of Dr. Aitken of London.

or rectum. Previously to its introduction, warm it in the hand or otherwise almost to zero-health. If it is self-registering, hold the bulb downward in the hand, and with one or two moderate swings of the arm, bring the upper end of the "index" almost to zero-health, = 37° C. = 29.60° R. = 98.6° F. (Be it said once for all.) And more, carry it upside down to prevent the mixing of the two columns of mercury in one. Read the indications, as directed by Aitken (in Aitken's directions), from the upper part of the index (higher column of mercury).

But the physician cannot be with all his patients from 9 to 10 A. M., and from 4 to 5 P. M., or oftener in grave cases; he has often to delegate this work of taking the temperature, and those he intends to trust he must previously teach. With the old thermometers medical students in hospitals might be trusted, and yet not too far (see Wunderlich); but it is almost useless for a family physician to ask a friend or a nurse to take and note the temperature at stated hours, when his experience tells him that, in spite of the most minute explanations and directions, the minds of nine-tenths of them will not comprehend what their senses cannot perceive, viz., the correlation of a scale of temperature calculated upon the thermal conditions of water or mercury, with the scale of temperature of the human blood.

Therefore, the question of putting into the hands of mothers and nurses thermometers whose scale corresponds with that of human temperature, implies that of the possibility for the physician of having assistants or substitutes, wherever the study of temperature helps to solve the problems of life or death; and this, too, is the *to be or not to be* of medical thermometry.

Great will be the changes with the new thermometer. If the physician must leave it to an attendant, he first makes him familiar with the zero standard of health; then with the fever significance of a rise above zero; then with the warning of depression expressed by the fall of the mercury below zero; and finally with the writing of the temperature *just as it reads on the stem* of the instrument. What the assistant understands well, he will do well; and who will not understand, when it is explained by a physician, this

SECTION OF THE MEDICAL THERMOMETER.

5°–6°	Death.
4°–5°	Almost always fatal.
3.5°	High fever.
3°	Considerably high fever.
2.5°	Moderate fever.
1.5°	Slight fever.
0	Norme Health.
.5°	Subnormal.
1°	Depression.
2°	Collapse.
3°	Algide collapse.
3.5°	Fatal collapse.

In this respect I am inclined to think that few of us do their duty. We dogmatically prescribe or order, and do not educate our nurses to appreciate how true to nature the practice of the present day has become; and how interesting and dramatic it is to follow the parallelism of nature and art evolutions, even for those who do not command them. It is so easy to interest these people in their hard and often repulsive labors; they would be delighted if they

could see, in an improved temperature, the result of their steady nursing, and soon they would, by their number, experience, and enthusiasm drive away from the sick-chambers the bats of charlatanism, and we should have in them no mean helps and allies. This reform implies the abandonment of the traditional forms of doctoral authority, whose rapid degenerescence in those of corporalism happily presages a near desuetude: a true, plain, or eminent physician loses nothing of his scientific authority by speaking like a man to men: honoring his subordinates, he encourages them, and honors himself: of all working men, the physician must remember that, if *there is ranks during labor, there is none in humanity.*

THE SURFACE THERMOMETER.

I published in the New York *Medical Record*, in its issue for January, 1867, an article on Medical Thermometry, which did not escape the bibliographic industry of Wunderlich (N. Sydenham translation, p. 42). In it I urged the necessity of inventing a thermometer for the surfaces, as we have several for cavities; and ventured to predict that it would come out, under the pressure of what I knew and wrote as A LAW, in these italicized expressions: *What mankind needs, man finds.* The question at issue was simply:—

A FEVER-THERMOMETER FOR GENERAL THERMOMETRY.

A SURFACE-THERMOMETER FOR LOCALIZED THERMOMETRY.

But it was not so clear then as it now is. The searchers sought for some modifications of the old thermometer, by which it could be used both for cavities and surfaces altogether; and worse, they wanted to submit to the same standard-measurement the temperature of the cavities, *which*, since Brechet's discovery, *has a norme*, from which it deviates in disease but a few degrees (ten), and that of the

surfaces, *which has no norme*, is nowhere alike, and varies by many degrees (above twenty), very suddenly, very often, and under the complications of internal and external conditions. Hence their failure.

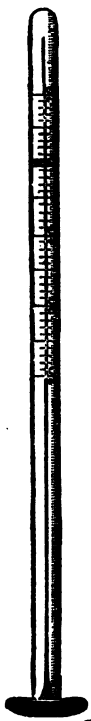
When I almost pleaded the necessity of this invention before the New York Medical Library and Journal Association, in a paper read December 16, 1870, it was fortunate for me to be unaware of the discouraging opinion against the possibility of contriving a surface-thermometer already expressed by Wunderlich. If I had then known it, I should probably have given up the attempt: thus, ignorance was bliss, though it is not safe to trust it; it served me in this case.

Not terrified by a great man's opinion athwart my path, I saw that the instrument must be exclusively to the purpose, and constructed with a view of acting on surfaces whose temperature depends on a large range of atmospheric and physiologic or pathologic combinations; most of them under the norme of pathological temperature.

In the absence of a "norme" I established one by "comparison:" from one side to another: from a well part to a similar or analogous part suspected to be sick: from a part in health to the same in a doubtful or sickly state, as the temporal regions, for instance (of which it is so important to keep the mean temperature as a point of comparison); from a part before, during, and after its exertions, by fixing two or more surface thermometers on the parts under observation.

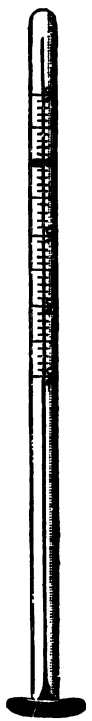
The comparison takes place either by transferring the surface-thermometer from one place to another, or (better) by using always two or more surface thermometers at a time. The temperature of the well side is "physiologic," or the *relative* norme; that of the sick side is "pathologic;" the difference between the two is the ex-

cursus of the local fever-temperature. This is the principle of localized thermometry.



The executive conditions of success of this new instrument were, a great sensitiveness to caloric; a plan easy to set and maintain on any surface of the body; and moreover, perfectly equal divisions of its register. I think these conditions have been obtained.

Modus operandi of the surface-thermometers. Have at least two of them perfectly alike. If their correctness becomes altered by usage or accident, make the compensation in your mind, or change them.



When you want to take an observation, warm them equally about three degrees below zero-health. Apply them perpendicularly, by simple apposition—pressure being reserved to test the upheaving of pulsatile tumors—to the surfaces selected, in this wise: upon a bi-lateral region, one instrument on the sick, the other on the well side; on a mono-organic region, one instrument over the suspected organ and the other over another viscera of quite similar temperature; for instance, one over the womb, the other on the epigastrium. Leave them three minutes *in situ* and read, then two minutes more, to make sure that you have attained the pathological difference between two points, whose physiological temperature (health) is alike. It is often necessary to apply, at the same time, the ordinary thermometer in the axilla, to see the amount of fever-temperature communicated to the system by the local process. For

continuous observations, a belt with numerous holes of the diameter of the stem of the instruments maintains the latter any length of time, and experiences may go on for hours or days without preoccupation or fatigue for the patient or the observer, wherever it is of interest to follow the *differences* and the *variations* of temperature, apparently caused by disease, medication, over-work, study, etc.

Wunderlich has shown how extensive is the application of the fever-thermometer to the diagnosis, prognosis, and therapeusis of general diseases. It will not be here out of place to indicate some of the cases in which the surface-thermometer has been or will be as valuable a bearer of positive information.

In local diseases of children, idiots, insane persons, and of other patients who cannot indicate the seat of their affection, the *surface-thermometer* may point it out.

In a great many feigned local diseases it will detect the fraud.

In the obscure beginnings of hemiplegia and paraplegia it shows a larger evolution of heat on the threatened parts than on the sound ones, and in confirmed paralysis the reverse obtains, the temperature of the affected parts being shown lower than that of those remaining sound.

In certain affections of the brain, not otherwise appreciable, it has shown a higher temperature on one side than on the other.

In metritis and peritonitis its markings have been a good guide to the treatment, and have proved concordant with the periods of danger and recovery. It may be equally sensitive to the local evolution of pathological heat in pneumonia, pleurisy, typhoid fever, etc., as in the slower affections, chronic meningitis, pulmonary phthisis, tabes mesenterica, chronic metritis and ovaritis, etc., etc. In articular rheumatism, sciatica, facial neuralgias, etc., it

will show elevations and falls of local temperature which may throw a new light on the origins of neuroses.

In intermittent fever it will establish the most pathognomonic sign, viz.: the exact difference of temperature in the trunk and at the several extremities during the cold and the hot stages.

It is yet the only instrument which can measure the power of calorification of localized electricity, of the Mayor's hammer, of calorific mixtures, and of medicines whose influence on local human temperature is not yet suspected.

With or without modification in the shape of the bulb, it will mark the changeable differences of temperature between a sick and a well eye, and may warn of the approach of the so-called sympathetic ophthalmia and of other accidents. Other specialists, besides oculists, may find it to their advantage to use the surface-thermometers, as I have known dermatologists do, to their complete satisfaction.

In the formative stage of deep-seated abscesses, their centre will often betray itself by a higher temperature. In chronic and cold abscesses it will not be so, and may be the reverse.

In deep-seated surgical lesions, the new instrument will often reveal the very centre of disorganization, or the extent of effusions, of which even a skilful hand may remain in doubt. When, according to the energetic expression of John Hilton, "A surgeon finds himself between two alternatives, 'plunge in the knife,' or 'wait till the abscess comes nearer to the surface;' but the patient may die in the mean while," then the *surface-thermometer* will rise higher at the centre of a tumor, even if there is abscess, or it will fluctuate like the sphygmometer of Jules Herrisson, if there is aneurism (that may prove to be one advantage of the flexible bulb.) It will be in frequent re-

quisition to follow the rise or fall of temperature in regions lately submitted to a grave operation, or hidden from view by an immovable apparatus.

Here is the place for the observation, that the mode of investigation instituted by the surface-thermometer is kind, and never presents the very grave dangers to be feared from deep palpations, percussion, succussion, and other manipulations, often unmercifully repeated for the sake of enforcing clinical demonstrations, or for the individual advantage of students. In any case the surface-thermometer will have also upon the hand, even the hand gifted with the *tactus eruditus*, the advantage of being early brought to a mean, known, and impartial temperature; whereas the hand—supposing it well educated—comes to the work of diagnosis with a variable warmth of its own, variously estimated, and variously interfering with the perception of the temperature of the parts under observation.

If I am well informed, the surface thermometer is already employed by eminent physicians, surgeons, specialists, physiologists, and chemists, who will give it an impartial trial, and soon make a just and competent report of its adaptability to their special pursuits.

The same remark obtains for the *new scale* of temperature, founded—for *medical thermometry*—upon zero-health instead of zero-melting snow, or zero-freezing of mercury of the physicists. They will neither be rejected nor accepted without due probation: criticism will come soon enough, improvements never too soon.

TABLES OF TEMPERATURE, ETC.

The complement of these two improvements in thermometry is a *new table of registration of the temperature*

(and other vital signs, etc.), so simple that any one who can write may fill it, and write the temperature, as it passes up and down the stem of the instrument, with the same figures and in the same relations to the norme, zero-health. This new table is rendered necessary by the progress of thermometry itself. When the wave-system was devised, physicians had mainly in view the record of the minima and maxima; but now the daily and weekly averages and differences are considered as equally interesting; but they have no place on the diagrams, and have to be extracted therefrom by separate computations: all very well where there is a large staff to do the work, and the mode of recording the temperature by waves of lines may remain the favorite for hospital records; but for private practice and for the study of isolated cases it is desirable to have a direct transfer of the figures of the thermometer written *en suite* like book-matter. This is what I have aimed at. It is a small, but singularly useful invention; a simple arrangement of the symptoms in their chronological order, susceptible of improvement at the hand of any one desirous of spreading the art and practice of medical thermometry. There it is in blank forms (p. 218).

The first line is given to the number of the thermometer (which must all the while be the same for the same case); to the name, age, sex, and disease of the patient, and to the head of the column of septenary records.

The second line is divided into seven cells for the numeration of the days of a septenary, and an eighth one for the numeration of each successive septenary. The first day of the sickness is mentally understood to be at No. 1; but the first day of the medical attendance and its record will have to be marked on the day they happen, be it the III., the V., etc., eventually leaving blank as many

Table of Temperature, Vital Signs, and Septenaries, to register one week's Observations, made with Dr. E. Seguin's Fever and Surface Thermometers.

NO. OF THER. NAME.	AGE.	SEX.	DISEASE.	SEPTENARY.

DAYS OF DISEASE.....	I	II	III	IV	V	VI	VII	No. 1.
Time of observation...	M~~E	M~~E	M~~E	M~~E	M~~E	M~~E	M~~E	
Temperature — Fever	.....	.....	.....	.....	.....	.....	.....	Total up.
Temperature — Zero Health								
Temperature — Depression	.....	.....	.....	.....	.....	.....	.....	Total down.
	~~	~~	~~	~~	~~	~~	~~	
Daily average.....	.....	.....	.....	.....	.....	.....	.....	Average of temperature.
Daily difference.....	.....	.....	.....	.....	.....	.....	.....	" of Differences.
Pulse.....	.....	.....	.....	.....	.....	.....	.....	" of pulse.
Respiration.....	.....	.....	.....	.....	.....	.....	.....	" of breathing.

cells as there have been days without medical observation.

The third line is divided into fourteen parts, for the morning (M) and evening (E) temperatures, and by a horizontal line which represents zero-health. The records of temperatures are written in these cells, *on* the median line for health, *above* it for fever, and *below* it for depression of vitality; exactly as the temperature passes *up* and *down* the *zero* on the stem of the instrument. On this double line can be read, at one glance, the daily remissions and exacerbations, the acme or the collapse, the effervescence and the defervescence, besides the possible relation of the latter phenomena to the doctrine of the crises. (To use this line to record the surface thermometry, the M and E are altered into the initials of the two points of the surface under comparison.)

The fourth line, divided into eight cells, gives the daily average of the observations recorded in the third, *plus* the septenary average. The fifth records the daily difference, and its weekly mean. The sixth records the pulse, and the seventh the respiration. Every new septenary comes *en suite* of this, without repetition of the headings, of course.

Thus the plan of this diagram embraces the temperature, the pulse, the respiration, and the critical periods.

Apart from the extreme simplicity of its writing and reading, there is but one feature truly novel in this table—it is the provision made for the *record of the critical days and crises* which may happen during each septenary.

DOCTRINE OF THE CRISES.

That is a small place offered to a very old, and once much revered host of ours, the "Doctrine of the Crises;" yet it is a larger one than modern hospitality proffers to it.

I allow it this square space on the "Table of Observation of the Vital Signs" and a few pages to the exposition of its almost divine pretensions. In return for which liberality—show-word for usury—I expect we may obtain, after a few years of diligent researches, the unveiling of strange coincidences, in the results once obtained by medical theurgism, and those now arrived at by medical thermometry.

When medicine was blended with theology, and therapeutics with theurgy, God was one, matter two, their union three, the universe twelve, its square root four, the perfect number,—whose union with three forms seven, which is endowed with particular virtues. Since Plato and Paul some of these figures have been somewhat altered. But then and correspondingly, Nature was medicative as well as creative. Diseases had, like all things, their proper lives and periods mathematically pre-ordained, in virtue of numerical and biological laws; hence their crises and critical days could be foreseen and foretold (prognosis).

Hippocrates believed in both, but—as far as is known—wrote on the subject only practically, not theoretically. Contrarily Galen, who admitted the crises, but rejected the critical days, wrote the theory of the latter, though under protest to the gods, whom he was in the habit of using as small change.

After that period, the old dogma fared still worse, being made subservient to the practices of necromancy, mysticism, saint-cure, etc. To make short a long story, nowadays many physicians—possibly not always the highest—are indifferent to the "crises" and skeptical as to the "critical days;" which is quite natural, having no means of verification commensurate with the magnitude of the problem. But dereliction is no reason; how many discoveries of Hippocrates—I call by his name him and his

times—have lately been *retrouvées?* Laryngotomy, auscultation, urinoscopy, etc.; is it now time that his dogma of the crises should too be finally tested by the standard of modern analysis?

Like all discoveries, this was the product of the copulation of several ideas; the Pythagorean computations, the data furnished by the highest education of the medical senses, particularly of the *tactus eruditus* (including the hand-thermometer), and the generalization of the hospital records of a school which the pretended father of medicine declares already very old in his time. Indeed, in the temple, school, and hospital of Cos, at least fifteen generations of Asclepiades had preceded him, practised upon all sorts of diseases, temperaments, and nationalities, and registered all their cases, likely above one million: materials fully equal in number and importance to those accumulated by our indefatigable thermometricians.

This was the treasure in which Hippocrates found the elements of his doctrines; not only on crises, but on revulsion and on sympathies, out of which, by the by, it took two generations of powerful Darwins to hatch the doctrine of "Natural Selection."

We can form an idea of the clinical notes of the ancient hospitals by those of Hippocrates. His "style" is his assuredly; since his apocrypha are recognized by the absence of this style; but his "form" is so much like a cast, that the description of his own cases seems prisoned in the routine frame of the Cos' Hospital Record.

We cannot so well form an idea of their "classification;" but they must have laid in some nosologic or other order, without which it would have been impossible to search for, and extract the elements of comparison from such a dense mass of facts, and to deduce from their

ensemble generalities like the Gnidian Sentences, the Aphorisms of the Master, and even the weaker precepts of Salerno.

Altogether the monuments demonstrate that, in private and in public practice, records were kept and made use of, not only for the advantage of the patients, and for the advancement of medical knowledge, but for the incubation of powerful generalizations and "pathologic laws."

It is in these conditions, which it was important to establish, that Hippocrates (and his school) asserted the dogma of the influence of numbers on the crises and cure, and referred to it as to a "law," whose eventualities, happy or fatal, may be calculated and predicted. He presented it as a law known before him, and which he confidently used as his surest "criterium." That it was "his" criterium is proven by the eagerness with which he seizes upon any opportunity of founding upon it his diagnosis and prognosis, of testing by it his treatment, and of introducing it in almost all his books as the fundamental principle of his teachings.

In the history of medicine there is only one thing like it: it is the industry with which Wunderlich (and his helpers of every country—I name him as the embodiment of thermometry—) has evolved pathological laws out of the innumerable and intricate data furnished by the thermometer.

But what is more surprising in this similitude than the similitude itself, is the quasi-identity of their results. Wunderlich, starting from mathematical computations, repeated and verified upon a magnitude only equalled, if at all, by the chief of the Coan School, arrived at conclusions which find their analogues in those deduced from the Pythagorean theories of numbers applied to the clinical treasures of antiquity. This coincidence, hinted at by

Dr. Woodman, will cause such surprise, and is so momentous for the progress of our art, that I will avoid, where I can, giving the facts in my own language, but let both Hippocrates and Wunderlich echo each other's doctrines and clinical experience at two thousand three hundred years' distance.

HIPPOCRATIC DOCTRINE

AND EXPERIENCE OF THE CRISES AND CRITICAL DAYS.

The living body is a circle without beginning or end; an harmonious whole, whose parts are in mutual dependence, whose acts in mutual solidarity.

This law presides in the phenomena of health, as well as in those of elimination and reparation in disease.

This latter and double elaboration, fever, *febris*, ends by an even resolution, λυσις, or by a sort of revolution, κρισις, at certain days called for this reason critical, decretory, or judiciatory.

He—who is desirous to predict with certainty the recovery or death, and how many days a disease will continue, or in how many it will cease—must understand the whole doctrine of the "signs," and how to compare their relative importance. Since the foregoing signs are true in Lybia, and in Delos, and in Scythia, you do not require the name of any disease which has not been particularized here; for you may know by the same "signs" all those which terminate within the periods laid down above (Third Book of Prognosis).

And what are these periods?

The "crisis" is an effort of nature to produce a change (beneficial or not), and which heralds the end of a disease.

The days are divided into "critical," "indicator," and "intercalary," and "non-decretory."

The "critical," decretory, or judiciary days are comprised between the fourth and eightieth; namely, the fourth, the seventh, the fourteenth, the twentieth, the twenty-seventh, the thirty-fourth, the fortieth, the sixtieth, and the eightieth.

Between each of these periods of seven or twenty days the crisis may take place, or sooner be "indicated" the next fourth day, thus: the fourth; the eleventh, which is the fourth after the seventh; the seventeenth, which is the fourth after the fourteenth, etc.; these are "indicators," in other words, give signs of an approaching crisis.

The "intercalary" days, the third, the sixth, the ninth, the sixteenth, etc., give issue to imperfect or irregular or fatal crises.

The "non-decretory" days, the second, the eighth, the tenth, the twelfth, the thirteenth, the fifteenth, etc., were not expected to give issue to crises.

To ascertain these periods "it is necessary to observe from the first day, and to remark the changes of every fourth day; and thus may the 'probable' termination be predicted" (Progn. Sect. 3).

Fevers come to a crisis on the same day, as to number, on which men recover or die. For the mildest class of fevers, and those originating with the most favorable symptoms, cease on the fourth day or earlier; and the most malignant, and those setting in with the most dangerous symptoms, prove fatal on the fourth day or earlier. Those who labor under the tetanus die in four days; if they survive this period they recover. Thus ends the first class of fevers.

(If in a continued fever the patient suffers most on the fourth and fifth days, and the crisis does not take place on the seventh, the case is usually fatal. Other ardent fevers (without remissions) terminate the seventh or fourteenth day.)

The second class of fevers is protracted to the seventh day, the third to the fourteenth, the fifth to the seventeenth, the sixth to the twentieth. Thus these periods, from the most acute disease, ascend by four up to twenty. But

none of these can be calculated by whole days, for neither the years nor the months can be numbered by whole days.

After this, in the same manner, in diseases of the same character, and according to the same progression, the first period is of thirty-four days, the second of forty, the third of sixty.

In the commencement of these periods it is very difficult to determine those which will come to a crisis after a long interval; for these beginnings are very similar, but one should pay attention from the first day, and observe further at the first additional tetrad or quaternary, and then one cannot miss seeing how the disease will terminate.

Those which will come to a crisis in the shortest space of time are the easiest to be judged of, for the difference of them is greatest from the commencement.

In the same manner are the crises of puerperal diseases to be ascertained, by calculating from the labor.

In the commencement of these diseases it is difficult to ascertain *à priori* in what space of time they will come to a crisis, for they commence very much in the same manner. But it is necessary to observe carefully from the first day, and to remark the changes every fourth day; and thus may the *probable* termination be ascertained.

The course of the quartans observes the same order.

The tertian fever terminates generally in seven periods.

Acute diseases generally come to a crisis in fourteen days.

It is easier to foreknow the "crises" of diseases which are to terminate in a short time, because, from the beginning, they differ very much.

The prognosis of diseases that are verging to a crisis is to be deduced from their duration and the manner of their "accessions."

When fever ceases without evident signs of the disease being resolved, and on days which are not critical, you may expect a relapse.

Those in whom the pain in the head commences on the first day, suffer greatly on the fourth and fifth, and die on the seventh.

For the most part, however, the pain commences on the third day, is much distressing on the fifth, and death occurs on the ninth or eleventh day; but if the pain begins on the fifth day, and "the other symptoms come in correspondent order," the disease will terminate the fourteenth day.

Young persons die of this disease (acute meningitis and otitis) on the seventh day, or rather earlier.

Relapses in diseases are most fatal to very young persons.

These rules hold good both in men, women, and children, and apply particularly to fevers of a tertian and continuous type; by these you may predict death or recovery.

If the Father of Medicine needed any sponsors, hundreds could be found among the highest authorities of recent times, but two will suffice. Sydenham says: "However true it may be that intermittent fevers may last six months, particularly under bad management, if you calculate rightly you will find that fourteen days of twenty-four hours each makes 336 hours; whilst, by allowing five hours and a half for each paroxysm of a quartan, you find in one full attack fourteen days or 336 hours." And Andral observes that "of ninety-three cases of pneumonia, twenty-three died on the seventh day, thirteen on the eleventh, eleven on the fourteenth, and nine on the twentieth. The recoveries on the critical days averaged fourteen, and in non-critical days hardly exceeded three."

WUNDERLICH'S DOCTRINE

AND EXPERIENCE OF CRISES AND CRITICAL DAYS.

The healthy temperature of the human body, disregarding diurnal "oscillations" and the slight "variations" caused by circumstances or moral impressions, is 98.6° F. =37° C. (=0 on the medical thermometer).

All temperatures which decidedly exceed or fall short of that norme are unhealthy, and "signs" of a diseased condition.

The typical course of temperature in many forms of disease is an undeniable fact, upon which is founded the idea that there are such things as "normal diseases."

Certain diseases in their progress obey certain laws, or rules, which can be determined by thermometric measurement of the course of their temperature: these are the "laws of pathological thermometry."

When thermometry thus discovers a new law of disease it reveals a "new world in the domain of natural laws."

Disease has its laws, but we cannot yet "codify" them.

A knowledge of the course of temperature is indispensable to learn the laws presiding over the evolution of certain diseases, and the deviation from these laws; to discover the tendencies to relapse or better, to regulate the therapeutic, to ascertain the convalescence, or to reveal complications, the imminence of peril, the impossibility of the continuance of life, the proof of the reality of death (Preface).

And what are these laws?

Temperature is the regulator of life.

Thermometry is the art of measuring the deperdition of life.

In physiological temperature the heat is generated and given off in such proportions as to keep the body at zero-health.

In pathological temperatures the equilibrium-health is broken by over or under production or emission of heat, in a proportion written up or down the norme on the medical thermometer.

Not only must we know the laws derived from this principle of unity of life; but in our application of these laws to special cases "errors are unavoidable when the initial period has not been under observation, and still more easily when no information as to the commencement of the attack can be obtained; and we are thus left in ignorance as to the time the disease has already lasted." Thus all our computations become uncertain. And more, before drawing conclusions from a single thermometric reading we must see the other symptoms, and consider if they agree or contrast with the temperature.

Under the name of "Ephemera" are included fevers which last only a few days; the length of the fever does not affect its height nor its issue. Diseases which begin with a strong pyrogenic stage have a short paroxysm, with a sharp elevation of temperature and a continuous course, ending in less than a week in defervescence or death.

Children exhibit more sudden and extensive changes of temperature than adults—more sudden "plunges" and earlier "elevations." A temperature of 38° C. may not be a sure sign of disease, but invites renewed applications of the thermometer.

In childbed a temperature of 38° C. is suspicious; the later the fever the stronger its course, sometimes reaching 42° C. and lasting to the fourth day.

In traumatic fever the defervescence is expected the

third day. The duration of pyæmic fever is a week, unless protracted by series of zigzag deviations.

The "Reign of law in diseases" is manifested in typhoid fever, through its irregularities.

The fevers may be divided into more or less clearly defined periods or stages: the pyrogenetic, the acme or fastigium, the decrement, proceeding or not by a *perturbatio critica* (lysis or catalysis), the defervescence and convalescence, or, on the contrary, the pro-agonistic period.

It is noteworthy that in the majority of cases which run a regular course, the duration of the separate periods corresponds in time with the division into weeks and half weeks. The alternation in the course, and the transitions from one stage to another, occur at the beginning or end of a week, or in the very middle. This type is most decidedly shown in the brief and mild forms, and in the third and fourth weeks of the more severe ones.

Periods in typhoid fever: the "initial stage," four days, describing zigzags, composed of morning elevations of 1°—1.5° C. and evening falls almost to normal, and reaching 40° C. the fourth day. This course is almost pathognomonic of the typhoid fever.

In the second half of the first week the morning temperature is lower by .5°–1.5° C. at the same time that the maximum is reached, 40.8° C.

The end of the first half of the fastigium most commonly falls on the seventh or eighth day.

The first half of the second week agrees in the main with the preceding period, but is marked, in cases whose course runs favorably, by less severe exacerbations. In very many severe cases there occurs, at tolerably well fixed days of the disease, either a transitory moderation, or a particular elevation of temperature. All irregularities in the second week are suspicious.

The "remission" seems to prefer the last day of the week or the middle of a week; the "elevations" come immediately before those days, or at the beginning of a fresh week.

The rise of temperature towards the end of the fastigium (seventh to fourteenth day) generally betokens complications.

We often observe a striking rise of temperature about the twenty-fifth day.

The beginning of "decided improvement" in cases of moderate severity is expected in the middle of the third week.

The regular course of typhoid fever is about twenty-one days; each relapse indicates fresh exudations and infiltrations of the intestinal glands; each better, elimination and reparation. This typical course of three weeks is not so well exhibited on the first attack as on the following ones. It is noteworthy that in the majority of cases of typhoid fever which run a regular course the duration of the separate periods corresponds in time with the division in weeks and half weeks.

Periods in typhus:—In moderate cases the temperature has reached its summit the fourth day, and about the sixth day is the turning-point, announced by a trifling decrease of temperature, followed by a greater remission the seventh.

Truly there is another rise about the eleventh, but it does not reach the previous maximum, and lasts only one to three days, after which the twelfth is marked by a preparatory remission. A third, but generally favorable rise, like a *perturbatio critica*, occurs, terminating in final defervescence. These simple cases terminate in two weeks.

In severe or neglected cases the continuous ascent and exacerbation continue through the first week at 40.2°–

41.6° C., or more. The remission of the seventh day is absent, and the high fever persists through the whole of the second week. The remission of the twelfth day is wanting or postponed to the beginning of the third week, etc.

But this comparison must be cut short, to limit it to its strict bearings on thermometry, whereas it interests all the important points of physic which cannot be introduced here. However, I have transcribed just enough of it to show that we are confronted with the double-headed fact that:

On the one hand, the first records of our art, founded on the theogony and geogony of numbers, applied to a persevering observation of the signs of health and disease; and on the other hand, the latest records taken and arranged by our most accurate men, with instruments whose precision is unimpeachable, of physiological and pathological temperature, and of other vital signs as well, have both developed the identical conclusion that: THE MOST IMPORTANT DISEASES (if not all) RUN A DEFINITE COURSE, IN DISTINCT PERIODS, AND IN SO MANY DAYS, WHOSE VIRTUE RESIDES IN THEIR NUMERAL ORDER, RECKONING FROM THE FIRST OF THE DISEASE. So said Wunderlich after Hippocrates.

That doctrine of the crises was for the ancients a dogma; in the dark ages it was a symbol; for us it must become a law, instead of remaining the *ignis fatuus* which lights our faces with its sardonic glare.

In presence of these facts what is our duty? Are we sufficiently advanced, and have we the instruments and methods efficent and sufficent, to give the old dogma its lasting place among the myths or among the natural laws? . . . . . .

That is the question.

We have the men, since the medical profession never

was so numerous, nor so rich in talents, nor so generally well educated. We have the instruments of observation, since they are invented or improved as fast as our labors demand them; thermometers, in particular, leave very little to be desired. What more do we need, then? . . . . To give the crises and critical days a place in our minds and habits, as they have one in the history of medicine—a luminous place in our daily records.

MEDICAL RECORDS.

There is no fear that the necessity of keeping medical records will be contested. On the contrary, there is danger that it will be argued that they are already kept; whereas few are, and how, and by whom? In truth, a small number of physicians record their cases in forms to suit their own habits of mind, not comparable at sight with others; a very few of them record their plain cases, whose masses could illustrate the questions of diagnostic and general pathology; and the others record and publish those extraordinary cases which once in a while startle the reader, not so much with the singularities of the disease as with the proliferation of the *I, me, mine*, etc. Contrarily, all the great observers, Sydenham, Andral, Louis, Wunderlich, have practically and theoretically demonstrated that the most ordinary diseases, and the most plain cases in these diseases, are the most fruitful subjects of observation; those which must be studied, and the only ones from which the progress of the theory and practice of medicine can reasonably be expected. But these observations, to be made available, must be taken in immense numbers, on a regular plan, and made comparable at a glance. Nothing can do it but a vast system of *Records*, simple, efficient, acceptable.

It is only quite recently that any attempt has been

made to generalize and systematize the medical records, so that the practice of different hospitals and of any and all practitioners could be compared at a sweep of the mind and eye. Now tables of vital signs, similar to those of Wunderlich and Aitken, have been introduced in all well-regulated hospitals, and the clinical observer can read them at the head of each bed when he goes along in the wards. But these tables cannot as conveniently be spread in the private bed-chambers; and the family physician finds it more convenient to keep his observations in his pocket.

To that effect a portable "Prescription and Clinical Record" has for several years past been prepared by myself, and published by W. Wood & Co., each new edition reflecting the progress of medical diagnosis.*

These tables, diagrams, or note-books, the offsprings of thermometry, do not contain yet any provision for the record of the crises and septenaries; but they are well adapted to receive them, and indeed look almost incomplete without them. But whatever form may be adopted, we are under the necessity of concerting some plan of recording our cases in a readable and comparable form, to find out the *law*—if there is a law—of the symptoms, periods, duration, recovery, or death, after the manner taught by Hippocrates, Sydenham, Andral, Wunderlich, etc. Of this work—demanded by the wants of that positivism which rules all the human and scientific affairs of our time—no true physician is too great, none too small, to keep himself aloof.

And yet there are some people who consider these records of private practice of small import; tedious to keep agoing, almost meaningless for isolated cases, and

* See II. Appendix.

impossible to bring together for the reading of their philosophy. I do differ from these disparagers (French *décourageurs*), because the physician's pocket-record, or his tables of vital signs, are already so framed that they can be filled in no time with the most accurate data of the methods and instruments of positive diagnosis. In them the physician sees the daily march of the disease, the effects of his treatment, and the foreshadowing issue of each case. But more, he reads in the *ensemble* of his cases the confirmation of, or the deviation from, the general and special laws of thermometry already discovered, and their modification by the medical constitution of each year; he learns the philosophy of disease in his locality at least, and prepares the materials he has at command upon the Hippocratic doctrine of the crises. But what will he do with these materials? . . . Like all of us, his personal experience is far too limited to have a significance by itself. What man but an Hippocrates, backed by fifteen generations of Asclepiades, can be trusted on such a question? . . . And we do not trust even him. But *there is somebody we can trust more than a Hippocrates: it is everybody.*

Let every physician bring or send his records of vital signs and critical days to his County or State Medical Society, there to be compared by a permanent commission, which will issue its conclusions only when the evidence of numbers and of gravity will have forced them upon the most skeptical minds. We have remained in alternate faith and distrust upon this question above two thousand years; let us remain in doubt a few years longer; things are going pretty fast nowadays, when executed with system, concert, and energy. In fifteen years, and with the help of the instruments and methods of positive diagnosis, a few men have discovered several laws of pathological

temperature. Is it unreasonable to suppose that, by a concerted action and the use of the same instruments and methods, in about an equal period of time we shall have gathered, classified, and criticised our million of observations on crises, and probably forever have got rid of the moot point, antique riddle, or incubus?

Thus the addition of a simple method of reckoning the temperature and other vital signs by septenaries, will have increased the power of the thermometer, as the addition of a cipher adds to the power of a figure. But I have not yet even hinted at the ruling influence which thermometry will exercise on therapeutic.

I have called the diagrams representing the curves of temperature, the tables of oscillations or deviations of the vital signs, and particularly the "Prescription and Clinic Record," the offsprings of thermometry; but it seems already apparent that they will stand—at least for practical purposes—in an almost inverse position, since, by each improvement in these methods, of reckoning, the instrument itself will conquer new fields of action, and practically, if not virtually, will acquire new powers.

In other words, during the past fifteen years the thermometer stood almost alone, like a little giant, doing the entire work of diagnostic discovery. In the next fifteen years its work will become more complex in pathology, and will reach farther than disease in human interests: progress which is due to and will be accomplished by the assistance of these offsprings of his—the methods of reckoning observations. In a word, *the next progress will come from the perfecting and popularization of the methods of using the thermometer, and the other instruments of positive diagnosis.*

THERMOMETRY REACTING ON PATHOLOGY AND THERAPEUTICS.

To pathology, thermometry offers a new test of diseases. The nosology of the XVIIth century resumed by Boissier de Sauvages, and the nosography of the XVIIIth written by Pinel, are founded upon the study of fevers through the pulse—the watch first instrument of positive diagnosis. But it is evident that the study of diseases with the thermometers will give very different conclusions; and that the present and the subsequent thermometric observations will virtually contain the first outlines of the next nosology.

To therapeutic thermometry opens a new era more promising than the one opened by the discovery of America. To the latter we owe the acquisition of the Peruvian bark and balsam, of the Mexican ipecac and jalap, of the mandrake and curare, etc.,—valuable specifics added to the list of the empirical arcanes: for arcanes they are in their action, if not in composition. But to thermometry we owe the mathematical regulation of the powers of two medicines, "heat and cold," the productor of warmth and the retarder of combustion, whose action on normal and abnormal temperatures becomes, with it, as positive as can be any operation of static, hydraulic, or chemistry. With thermometry, heat and cold, antithetic terms, or poles of the force-temperature, are convertible into movement, activity, thoughts, feelings, and all the manifestations of life. In showing us how to use them mathematically, thermometry has truly discovered—according to the vivid expression of Wunderlich—a new world, the one dreamed of by Currie, the law of the action of external upon human temperature. But this therapeutic application of the two relative terms of caloric to the treatment of dis-

eases is only the initial impulse of an immense revolution, whose subsequences, hidden to the view of the far-seeing Currie, are hardly traceable in our horizon; I mean, the calorific and frigorific action of all our medicines, vegetables and their alkaloids, metals, metalloid bodies and gases. This entirely new field of observation, and of therapeutic action, would vanish like a mirage if thermometry could be suppressed. But, far from this impious impossibility, thermometry will find out even the positivism of empiricism in the law of concordance of the apparently most discording treatments; and will reconcile schools which were divided, only because they did not know that their far-diverging means converged to the same action and object—the keeping up of normal temperature, that is to say, life; and the suppressing of the sources of pathological temperatures—that is, death, *in propria persona.*

In the Prescription and Clinic Record above referred to, tables will be found already arranged to record the results of the treatments by electricity and tetanic remedies upon the body's temperature, and upon the most important functions. But this is evidently only the beginning of a great reformation.

POSITION OF THERMOMETRY IN DIAGNOSIS.

One must have noticed that the observations of temperature have been carried with such enthusiasm that they have left in their progress, distanced behind, the other modes of observation, except microscopy; and thus comparatively lowered the standard value of the other symptoms. This exclusivism may have been quite natural during the crusade for the propagation of thermometry, which, like all new religions, was not preached by half; but now that its success is assured, it is wise to see to its legitimate spread, and to the place it must occupy, not instead of,

but among the other means of diagnosis; assuming its normal position, thermometry will gain in associated strength what it may have to lose in solitary grandeur.

Having only a small space, and wishing to speak with authority, I will borrow the words of the most concise of medical writers, to convey, with due force, these views on the subject of correlation of all the symptoms. "It is a bad symptom when the head, hands, and feet are cold, when the belly and sides are hot. But it is a very good symptom when the whole body is equally hot." This ranks Hippocrates among thermometricians; but far from being an exclusive one, he instantly adds: "He who is desirous of being able to predict with certainty the recovery or death of the sick, and how many days a disease will continue, or in how many it will cease, must understand the whole doctrine of the signs, so as to be able to judge of all the symptoms, and to compare their relative importance according to the *rules* . . . ." (Prognostics, p. 3.) So we were forewarned against this natural tendency to exclusivism, of which Bordeu furnished an example which can well serve as a lesson. After writing his four volumes on the "Pulse," he would go through the Charity Hospital without looking at his patients, only feeling their pulse and prescribing: astonishing the crowd of students by the acuteness of his diagnosis. Malicious chronicles do not say that he likewise refused to look at his quasi-royal patient, the Duchess de Pompadour; but grave history attests that his successors in the celebrated clinic, Laënec and Andral, founded their famed diagnosis upon the even exercise of all their exalted medical senses.

After all, the practical point of this is contained in these few words of Hippocrates: "We must understand the whole doctrine of the signs." The doctrine may be improved; the number of the signs may be increased; it must

not be diminished, under the penalty which has overtaken our predecessors for their neglect of Hippocratic urinoscopy. The signs furnished by the temperature are, indubitably, invaluable, but they cannot take the place of all or any one of the others; for instance, of those that the diverse qualities of the perspiration gave to the ancients—so neglected to-day; and of those vainly proffered to us by the specific odor of almost every disease—which odors our olfactory organs cannot read, because we have not yet in the medical colleges courses of training for our sensory instruments of diagnosis.

But the connections of human temperature and of pathological and physiological thermometry tend farther in two directions. By the comparative study of the "concordance" and "discordance" of the three great vital signs, and by the concurrent use of the thermometer, with the sphygmograph, the myograph, the microscope, the æsthesiometer, the dynamometer, and other instruments and methods of "positive diagnosis," we will soon be able to settle, like mathematical affairs, all questions relating not only to disease, but to vitality, longevity, and adaptability to the various climates, altitudes, longitudes, training, studies, sports, indulgences, labors, individual and social fitness.

These last lines of our plan sketched before us, we can now acknowledge, without endangering the cause of thermometry, that the rhythm of the circulation or of the respiration *may* not conform with the height of the temperature *secundum* our former notions of the necessity of concordance of the three great vital signs. The simple acknowledgment of the possibility of these pathological "discordances" will open a new road to positive observation; and instead of weakening the value of thermometry, will extend its diagnostic powers to new fields of the domain of law in health as well as in disease.

These discrepancies to the rule—nature is always larger than our rules—are no exceptions, but co-ordinate manifestations of some order in the biological phenomena, which, once studied, will become law in their turn.

Wunderlich signalizes one form of these discrepancies in the pre-agonistic period of several fevers, where the temperature comes down almost to zero-norme at the same time that the pulse rises immeasurably; but this is only a striking and irremediable anomaly. I have particularly in view those disruptions of equilibrium between the three great vital signs accessible to observation and to therapeutic; some occurring in definite affections of one of the major viscera, and others under the localized action of debilitating agencies; and those more hidden ones, which undermine youth, beauty, talent, ambition, love, devotion; subtle disorders, whose catalytic operations are past the regenerating powers of our present knowledge, unless their very incipience is detected in time.

But one would say these anomalies are almost insensible. Pulse and breathing normal, with a rise of one degree, or an habitual fall of half a degree temperature below zero-health; or pulse and temperature normal with only three respirations too much; or respiration and temperature normal and pulse accelerated only by five beats. How insignificant an anomaly at the time it is noted! But how much is it increased by excitements? And to what total in months and years will this continuous deperdition of heat, and these millions of imperfect circulations of badly oxygenated blood amount? . . . Their figures are too large to be written, but their final appellation reads hectic, phthisis, dropsy, etc. Thermometry signalizes these occult perils to the pathologist by uniting its data to those furnished by the observation of the other vital signs.

Moreover, the range of its diagnostic powers has been and will yet be greatly extended by the combination of its action with that of the instruments and methods of "physical diagnosis." This combination of both the surface and the fever thermometers with the stethoscope, laryngoscope, specula, plessimeter, etc., will bring into focus many facts which, scattered, had no possible diagnostic connection. I cannot diverge from my central objective point to dwell upon the consequences of this alliance of thermometry with physical diagnosis, but I can spare a few paragraphs to indicate some of the operations which the thermometer can accomplish at the head of, and in collaboration with, the instruments and methods of "positive diagnosis."

PHYSICAL AND POSITIVE DIAGNOSIS.

But first, as I have originated this division of the instruments of diagnosis into "physical" and "positive," I may be allowed to support this proposition by considerations which will, in my judgment, altogether enlarge and specify the functions of the thermometer itself.

The "instruments of physical diagnosis," stethoscope, ophthalmoscope, specula, etc., are always, like spectacles, accessory to our senses, to which they give a farther reach and a finer accuracy.

The "instruments of positive diagnosis," the microscope,—for a part, at least, of its investigations,—thermometers, dynamometer, etc., are substitutes to our senses, and give automatic results which cannot be influenced by the personal modalities of the senses or of the mind.

Practically, the results obtained *with* the instruments and methods of physical diagnosis are the expression of individual sensory impressions rendered in the individ-

ual's own language—impressions and language which necessarily vary from man to man, and cannot be finally adjudicated by a more stable authority. From this *modus operandi* arise all the doubts and controversies consequent upon auscultation and percussion; what is perceived through the stethoscope can be "controverted."

Practically, the results obtained *by* the instruments and methods of positive diagnosis are given out by the instrument itself, in figures or diagrams which the imagination of the observer cannot alter, nor his power of rhetoric enlarge or color (deliberate lying excepted). Their arithmetical or geometrical results will always come out identical, when taken in identical conditions; and when taken by several instruments of positive diagnosis they will sustain among themselves a concordance that bespeaks truthfulness, and which, moreover, could always be controlled from whatever distance. What all the instruments of positive diagnosis "indicate" are unchallengeable "indications," which it remains only to read and interpret correctly: what the thermometer says no man can "contradict."

From this it appears that the instruments of physical diagnosis may corroborate but not invalidate the testimony of the instruments of positive diagnosis; but that the latter can reaffirm or negative the findings of the former, and even can testify of pathologic symptoms on which the other remained silent or doubtful.

Another practical difference between these instruments is that those simply "physical" are more fitted to give an account of signs and symptoms *as they are*, and the "positive" ones *as they will be*, also. Thus auscultation, speculation, etc., afford an idea of the present state, but unless frequently repeated furnish uncertain clues to the progression and durability of affections; whereas the operations

of the thermometer, æsthesiometer, etc., need hardly be repeated twice, in ordinary cases, to permit the prediction of distant issues. Therefore the former are decidedly best —but not exclusively—adapted to the diagnosis of actual diseases, and the latter more pointedly to the pre-diagnosis (in a certain sense a prognosis at longer range than usual) of the deficiencies and wastings of vital forces which threaten longevity, not so suddenly, but more surely than disease itself.

We have seen how the thermometer has increased its working capacity by the accretion to its own data of those furnished by the pulse and respiration. We will now see what working capacity it will gain by its partnership with the measurers of circulation (the sphygmograph), of contractility (the dynamometer), of sensibility (the æsthesiometer), etc., . . . and more, by its own adaptation to the measurement of surface as well as of internal temperatures, in the physiologic as well as in the pathologic conditions of life.

Here thermometry and its allies in positivism almost cease to be medical; become human, social, commercial, and the most direct agents of progressive morality. I cannot, of course, follow it through all these new fields of observation, even at the speed of the previous suggestions; and must content myself with the delineation of a few of its most important new features.

PROGNOSTICATION BY THERMOMETRY, ETC.

I will first remark that thermometry and its adjuncts are of paramount importance in all the interests resting upon the contingencies of life or death. In all important questions men want to know the future; in a state of expectation anything is better than nothing. On the banks of the Cephyse, Niger, Orinoco, Winnipeg, as in the by-streets of

Madrid, Paris, New York, the *sac à médecine*, the cards, the turning tables, the bones of St. James, Ste. Rosamonde's tooth, etc., are asked, What next? The educated classes, knowing the trumpery, silence their curiosity because their education taught them nothing but the past, and self-reliance for the future. And it is a pity! Since astronomy succeeded astrology, and chemistry alchemy, as sure as positive diagnosis is slowly but surely taking the place of conjecture and imposture.

It is a pity for which we are responsible. We ought to educate our public to understand the individual, commercial, and social value of the "predictions" founded upon the signs of health and vitality given out by the physical, chemical, microscopic, and thermometric methods of diagnosis. This knowledge makes us the exponents of the laws of temperature, physiological dynamics, and affinities; from the observance or dereliction of which we can predict the rise or fall of conceited self, of ignorant families, of blind nations. That is our main function in society, besides that one to which we like to confine ourselves, of Sextons of Catalysis. Let us remember: the excellence of the physician is in the prognosis. (Hip. Progn. 1).

To speak pointedly, I mean to say that our main function is to advise, not the sick, but "those who being well, or apparently well, may become exposed, or protract their exposure to loss of life, or to incapacities and infirmities worse than death by *lysis*, through the crevices open in their vitality by the straining of the exigencies of modern life."

In this part of our profession we claim the whole world for our clients. So, unadvised men and women will choose a life-partner who will kill them with their love as sure as with a bullet; or men will be provided with industrial or commercial occupations for which the diagnostic tests by the positive method would declare them incapable; such

timely prediction often saving their life or the interests of their employers. Others will invest, with their money, the honor and future of their families in a business from which they would desist if they knew that the sphygmograph could describe the exact depression of an ambolic arrest in their circulation, or the surface-thermometer show a half degree difference in the heat of the two sides of the body, or the dynamometer a growing though slight difference of contractility in the two hands.

Indeed, I do not consider physicians exempt from blame who keep the knowledge of the social value of these positive tests of vitality to themselves until they are urged, in the name of the sick or the dying, to communicate them. Men, educated as they now are to be blown up without the sixtieth part of a second warning, must be, methinks, prepared to see without flinching the advance of the signs of their own devitalization, with two compensations—one that the chances of postponing the crisis are offered by "he who prognosticating best can prescribe best" (Hip. Progn. 2); and the other, of quietly settling the interests of those dear to them, in view of the eventuality of the foretold departure.

But life and death are no more the simple individual phenomena they used to be in mankind, as among the rabbits. The most insignificant unit of the genus (woman or man) cannot disappear without breaking social or financial connections. In this respect the thermometer holds in its tiny stem the fate of mighty interests; let us only consider how fare without it, and how would fare with it, those interests having their origin in life insurance policies.

THE THERMOMETER FOR LIFE INSURANCE.

The financial guaranties presently offered by the life insurance companies are considered as very insecure. I

know nothing of the accusations published against their officers; but I know that if these smart men were not looking somewhere else for a set-off, most of their concerns would soon break down under the mismanagement of their medical (diagnostic) department: there is the flaw in the life insurance companies. They have remained profoundly or willingly ignorant of the resources offered them by the recent improvements in vital diagnosis; in the midst of the progress of all trades and industries few of them have improved the medical guaranties devised for their own security half a century ago; meanwhile the applicants for policies have become more and more crafty in the art of insuring death instead of life.

It is very seldom that a man actually sick asks for the benefit of a policy of insurance (for which *physical diagnosis* would instantly detect his unworthiness); it is, on the contrary, of common occurrence that, as soon as a man feels, or his relatives suspect, that his vital powers are imperceptibly but steadily declining, he becomes an applicant for a policy; the larger, because they know he will not live long enough to pay several annuities. On these cases *physical diagnosis* throws very little light indeed, whilst the instruments of *positive diagnosis* would denounce the fraud with unanswerable evidences.

Two cases which recently came under my observation illustrate the respective situations of the insurer and insured.

A man of 65, after an attack of apoplexy followed by slight paraplegia, had his life insured and died within a year. Another, not over forty, but completely exhausted and worn out, came to me boasting that a company had insured his life, notwithstanding that I had told him that I would not give two cents for it; within six months he had a pneumonia that he had not the vitality to carry to

the seventh day. Moral No. 1.—The wives of each respectively pocketed five thousand dollars. Moral No. 2.—In the former case, the sphygmographic traces would have been blunted by senile calcification, and otherwise distorted by the irregularity of the waves of the circulation. In the latter case, thermometry would have shown evening elevations of temperature of more than two degrees; both pathological signs forbidding or invalidating any contract of insurance. In this unequal contest, the managers of the life insurance companies are said to have recourse to unfair means, instead of borrowing their protective weapons from *science*, which *always comes to the rescue of those who diligently ask for its assistance.*

The officers of these companies know, from long experience, that their great losses do not result from mortality caused by acute diseases, casualties largely provided for; but that they are imposed by comparatively sudden demises caused by chronic conditions not diagnosed by their physicians, and not provided for in their calculations. Knowing this, they should soon have learned that the means of physical diagnosis employed by their agents were more appropriate to ascertain actual diseases than to measure the vitality and longevity. A step more in the same line of inquiry, and they would have found that the instruments and methods of positive diagnosis, the thermometer, and the study of temperature in particular, offered them the surest guaranties against the dishonesty of their customers.

Who of these smart men would not instantly have introduced thermometry among the means of examining the applicants for a policy, if he had read what Sidney Ringer said in his *Temperature as a Means of Diagnosis*:—"The temperature may be taken as a measure of the amount of tuberculosis and tuberculization, and any fluctuations in it

indicate corresponding fluctuations in the severity of the disease. The temperature is a more accurate indication of the amount of tuberculosis and tuberculization than either the *physical signs* or the *symptoms*. By means of the thermometer we can diagnose tuberculosis and tuberculization long before the *physical signs* and *symptoms* are sufficient to justify such diagnosis." And what is more pathognomonic of paralysis, for instance, than a progressive difference in the contractility or tactile sensibility of both sides, as mathematically demonstrated by dynamometry and æsthesiometry?

Soon the signs given by the method and instruments of *positive diagnosis* will certainly increase in number, accuracy, value, and importance; but even as they now are, they offer to the life insurance companies—without excluding other methods of observation—the surest means of fighting successfully the ever-living demon of cheat, and of fairly and successfully managing their own business.

But dear as money may be, there are things dearer yet, upon which thermometry and positive diagnosis will be brought to exercise a leading control; among these I name EDUCATION.

THERMOMETRY IN SCHOOLS.

I hope the next progress in education will be such that, before twenty years, my veracity will be impugned for saying that, in this present month of October, 1871, out of three millions of children entering the schools of our country, not one will be examined in regard to the state of his great vital functions, the harmony of his motor and sensory apparatus on both sides, the effects of muscular exercise and of mental efforts upon his circulation, respiration, and local and general temperature; and no individual record taken of these, to ascertain the effects of the

curriculum upon the further development of the children.

To me the subject is so impressive that I hardly dare to touch it; still I must go on, knowing the while that I cannot expect to do it justice in these few brief paragraphs.

During the years children go through their school education, they have to grow too; so willeth Nature. One of the effects of this transitory function of growth is to throw a great disturbance upon the ordinary functions; the more since, by a constant interstitial accretion of neoplasm and new cells, every part changes its actual, and all parts their relative positions in each organ as well as in the whole body. Some children die in this body-quake, and more come out of it bent or crippled, never to rise again in beauty and capacity. But what of those who, meanwhile, have to pass through the ordeal of stupendous studies or stupid immobilities? . . .

They are superintended and taught by doctors in all the faculties, but they have not yet seen the one whose duty it is to be "keeper of the ledger of their vital resources."

Out of the cyclopædia of symptoms which warn against the degenerescence of organs and the exaggeration or decline of functions, in children under training, I will suggest: the daily elevation of general temperature during the latest hours of study; and the following irregularities in the distribution of local temperature—as per surface-thermometer. Extremities cold and body too hot. General coldness, with either dry heat in the palm of the hand, or a cold and abundant moisture of the whole hand. The same general coldness with parched and peeling lips, and inordinate thirst; or localized heats signalized by a flush on one cheek, oftener on one ear, not always on the same; or an over or unequal temperature on the two temporal regions, marked by a deeper blueness of their venous arbo-

rescence. The hand-thermometer and the sight admonish of these dangerous anomalies; the fever and surface thermometer measure them, and also the pyrogenetic action of the elements which enter into the school life.

The body development of the youth is accomplished by oscillations, zoological seasons corresponding, if not in times, in operations at least, with those which regulate the development of vegetables. In one of the springs of these physiological years of children, some of them will undergo remarkable changes, of which note the following:—

They feel all the uneasiness attending growth, and yet they do not grow; but symptoms which cannot be synthetized under the name of a particular sickness lurk about their frame—mark their anorexy and dirt-gray skin. If this state is not closely watched by thermometry, and treated by revolutionary changes of climate, training, food, etc., a secondary fever supervenes, which carries off the child; or receding, leaves bare to view a constitutional affection: this process of "degenerescence of system," affects particularly the nervous, lymphatic, and osseous.

In another case the child looks above his fellows in amplitude, freshness, and rich curves; he is amiable though irritable, kind, and studious; but has oftener become tired than can be accounted for. The danger is of a "degenerescence of apparatus"—of the locomotion, for instance. Whoever has followed with wonder the hasty spring growth of an elder's sprouts, and seen one of them suddenly dry up pithless amidst its sappy fellows, can form an idea of this "degenerescence of special organs," by localized deficiency of nutrition.

This form of "localized arrest of nutrition," French *décroit* (Trousseau), popularly *dégras*, is always unilateral, a character which permits us to detect it early, by the com-

parative use, on both sides, of the instruments of positive diagnosis: of the surface-thermometer, which will detect a coolness of half a degree and upward on the suspected side, long before any other sign of the affection can be otherwise descried; of accurate measurements which will spy the difference of size of the limbs; of electricity and æsthesiometry, delicate tests of tactile sensibility; of the dynamometer which gives mathematical evidences of difference of contractility located in the hands and arms; and of the dynamometric swing, excellent test of that of the lower limbs.

The gravest affections of the nervous system, central and peripheric, visit the young student in proportion, it seems, to the severity of his training; and are almost unknown among the young vagabonds and street boys. I intentionally choose these two extremes to show what nutrition is, and what non-nutrition can produce. The college children are better fed than the abandoned children; yet they receive less nutrition from their food because they spend in mental and other exercises more of the *pabulum vitæ* than their food—supposing it the best—could afford. To show that this bankruptcy of nutrition, by inordinate expense of the pabulum, is the cause to which we must refer the majority of the nervous affections I have in view, and their reactions on the rest of the economy, I will take, for illustration, one too frequent and too fatal among young scholars—meningitis.

It is in its various forms as complex as the etiology of these forms. However, from the baby who ceases to be nourished, though he is fed, the moment his nurse becomes pregnant, from the child overpowered by heat, and the student by his studies; that the subject be not nourished enough, or spend too much pabulum, the multiform affection—under the symptomatic name of "cerebral fever"

(Trousseau)—may be referred to an insufficiency of the vital properties of the blood, and its causes synthetized in "deficiency of nutrition"—of whatever origin, of course.

HUSBANDING THE VITAL FORCES.

For there are more ways than one to "starvation." When we spend more than we can assimilate of forces expressed by caloricity, as in the previous example of the school and vagrant boys; when the blood is not well oxygenated, nor rich in red corpuscles; whenever it does not penetrate all the tissues by circulation and endosmosis; whenever its serum lags behind in its primary form, or in that of lymph, pus, effused fluids, surrounding or not miliary and tuberculous deposits, there is "deficiency of nutrition."

And as there is a general and a local circulation, there are local as well as general starvations, caused by the devitalized elements of the blood remaining behind in certain localities. If it is cruor, it produces gangrene, dry-rot, etc.; if it is serum, it produces dropsies, tubercular affections, etc. A continuous congestive state (orgasm) disposes to a separation of the components of the blood, and to their transformation into secondary products, as much as a prolonged scantiness (anæmia); hence the unrelenting attention exacted from young students makes their meninges the particular seat of vascular congestion, which cannot fail, sooner or later, to end in thickenings and protean formations, which devote the school-laureate to vulgar incapacity, imbecility, or death.

The teacher must know that all the operations exacted from a child—actions, perceptions, emotions, imaginations, thoughts, and volitions—are the direct, reflex, or converted products of sensory and cephalic movements, manifestations of a "force."

This "neurine force" is "fed and spent, never lost,"

but "converted" into labor or "wasted" in shocks and frictions. In regard to this neurine force, those who assume the charge of the youth "will" have twofold duties: one to direct its usage through the muscles, senses, and mind, so that they could produce the most valuable labor with the least friction or shock; the other to keep a constant equilibrium between the forces incoming and those going out. But this duty includes a third, more important than both: it consists in husbanding the nervous and correlating forces, so that the children will have enough, not only to spend in labor, in growth, and in necessary repairs of their organism, but always enough in store to spare for an emergency, like extra-work, exposure, disease, surgical accidents, etc. This investment, managed by the true manager of a school, is the real insurance of life and of future capacity; without it, the existence or the welfare of children are never secure.

Therefore, not content with having ascertained their condition at the beginning of each course, we must continue to record their vital signs and the working of their functions periodically for all of them, and more frequently for those whose condition is suspicious. The general thermometer will detect fluctuations (more than diurnal oscillations) in a child too much confined; the local thermometer will descry a line of fever-heat at the base of the forehead in another who over-taxes his memory; the sphygmograph will trace the jerked pulse of one who has been running or boating to excess, or an intermittent one for more secret reasons; the spirometer will show a loss of inspiration which corresponds with a loss of circumference, or with a lateral depression in the chest, as per tape-measure and lead circle; and the dynamometer will mark a weaker contractility otherwise suspected by the circular measurement of the

arm and from the loss of body weight, etc., in the young one's crouching for hours upon books.

This positive knowledge of the organic and functional condition of each child once acquired and steadily kept up, like a commercial account, let the programme of instruction, or even the plan of general training be what they may—dictated for some years yet by pride and love of the useless—the man in charge of children must in any circumstance manage them upon this physiological basis:

Every animal is a producer of heat, and correspondingly a consumer, too.

He must produce enough of it to live, to grow, to repair its constituent elements, and to move towards its ends, whether man, child, bird, or buffalo.*

The degree of normal production of temperature is the measure of the physiological capacity for action, *alias* latent force.

The first duty of the teacher is to see that there is no useless consumption of this latent force by friction, shocks, etc., as may be ascertained by thermometry.

The second is to supply this force by sufficient food, exercise, aëration, and insolation.

The third is to consume this power in preparing the child for the most useful and congenial modes of activity.

To work—at school or in the fields—the child consumes the organic materials of his blood.

This "ustion" is the *sine qua non* condition of labor.

The thermometers are the "meters" of this local or general ustion, and therefore the index of the capacity of each child for labor.

I most respectfully call the attention of the otherwise so learned and capable superintendents of schools and semi-

---

* See Comparative Table of Temperatures, page x.

naries towards these principles, the bases of the physiological conditions in which the children must be kept during the entire time, and at the different periods of their tuition and growth.

This must be the object of the earliest reform. The man who understands best the pyrogenic conditions during labor must be the teacher, not only of the pupils, but of the teachers; and will cause to be written in each schoolroom—but in words invisible for the young: THE CURRICULUM IS MADE FOR THE CHILDREN, NOT THE CHILDREN FOR THE CURRICULUM.

I began this exposition of the application of thermometry and of the instruments and methods of positive diagnosis to the general elements of education reluctantly, knowing that I would close it without having room or courage enough to say a tithe of what has so deeply and painfully impressed my own mind.

I enter more hopefully upon the exposition of the next point, upon which positive diagnosis will be called to exercise a leading control—the use of the thermometer in the management of children by their mothers.

THE THERMOMETER IN EVERY FAMILY.

I hardly need say to a mother that the question of temperature takes the precedence over all others in the rearing and breeding of her offspring. She knows that from the first moment, coming out from its liquid atmosphere and its soft surroundings, itself warmer than either, the new-born infant feels our air like a chilly combination of needles and vinegar, in which it loses at once several degrees of temperature—enough to give the ague or kill grown people. This knowledge by sympathy explains how, yet in pains, her first inquiry is if the baby is warm. That is it. That is and will be the main question. Is

it warm? . . . Is it too warm? . . . Is it warm enough? . . . Is it equally warm? . . . That is it. She knows more with her feelings than we do with our books. I have only to show her how to make use of her heart-knowledge.

If the body temperature is the first thing to be considered, the instruments to "take it" are the second, and the method of "appreciating it" in health and disease is the third.

To nobody is the thermometric power of the hand so indispensable as to a mother. Happily the hand of women is generally better educated to "feel" than that of man; a great superiority, indeed, which compensates for many assumed ones on the other side.

In nursing children, this capacity of the hand to feel—allied to the other delicacies of contact and prehension of which a feeling hand only is capable—is so indispensable, that I cannot understand how those who do not possess these tactile and prehensive delicacies of the hand dare to touch a new-born infant, unless to break it.

Not that this delicacy of the hand is acquired by our present systems of education: I have seen refined women handle a child with their elaborately softened and be-decked hands as pinchingly as the spider does a fly with her forceps; and rustic women carry it in their clumsy hands as softly as in a cradle of butter.

However, since there is an art in everything, and all baby-nurses are not mothers, I will give some directions for the use of the hand-thermometer.

The instrument of "physical diagnosis" which a mother has always at her disposition, the hand-thermometer, must be kept, like all instruments, in working order; "smooth" on every surface, particularly about the pulpy end of the fingers and nails; "clean," not only from vulgar impu-

rities, but from the products of insensible perspiration which may affect the yet immaculate skin; "warm" at 3°–2° med.=34°–35° C. before coming in contact with the body. For, a temperature to be appreciable, must not be revulsed by cold; moreover, the child ought not to be made to suffer by a manœuvre intended to ascertain its health and comfort.

For its thermometric manœuvring the hand is applied in the following manners and progressions:—

The pulp of one or more fingers—according to the size and shape of the region to be explored—after hovering a little while near it, enters without suddenness into the slightest contact with the skin of the child, to—so to speak, by similitude—aspire from it the most superficial emanations of caloric. The soft pressure is made deeper after each impression has been distinctly received, and stopped when no more change of temperature is perceptible. This gives a better idea of the location of the inflammation than the medical thermometer itself. Then, for obvious reasons, the hand is gradually and slowly removed. The importance of this manœuvre is well exemplified by the gradual perceptions of heat received from the neck, according as the cause of the pyrexia is superficial or profound, as it gradually is in erysipelas, scrofulous inflammation, parotitis, putrid sore throat.

If asked "when" the hand of a mother ought to be used as a thermometer, I answer, without hesitation, "always." But "not always in the same manner."

With a healthy child the caressing hand is involuntarily inquisitive of any possible abnormal temperature; while, with a puny or convalescent one, it is the inquiring hand which is caressing. But in sickness the anxiety of the mind is communicated to the hand, which spends more nervous skill in investigating the temperature than in petting,

so that, out of the millions of modes of contacts of the hand of a mother with her child, I dare carve tactile categories corresponding to the intensity of purpose of the application of that hand as a thermometer—truly, physicians are merciless.

By the same rule, the urgency of using the hand-thermometry begets its frequency as well as its topographic action. With healthy infants it has to be resorted to in the morning before nine, in the afternoon after outside exposure, at bed-time, and one hour or more later, without disturbing the sleep; the survey comprises the head, neck, chest, epigastrium, iliac region, extremities, more carefully the epigastrium the first year, the head (parietal and great fontanella regions) during the teething, the iliac fauces when solid food begins to be greedily and almost toothlessly ingested; the chest when the outside temperature is any way excessive or versatile.

With older children the explorations should be gone through whenever reckless activity, thirst of knowing, indulgence in food or drink, and circumstances to be espied as they occur, give rise to anxiety for any of the important apparatus of the life of relation or nutrition, whereas the investigations will be particularly directed towards the weak or affected parts in the delicate or the convalescent.

During these more frequent than daily explorations, the hand of the mother has acquired a delicacy of perception which would be desirable in that of physicians, and by which she is made aware of any true, general, or local disturbance of temperature. With the hand alone her knowledge cannot extend farther, she is made sure that "there is a disturbance;" but it is only with her two medical thermometers that she can, in five minutes, gauge the "extent" and "intensity" of the abnormal ustion.

Here ends her part as a pre-diagnostician.

[I must say to her incidentally, that with young children much contention is avoided by introducing the fever thermometer in the axilla from behind.]

As soon as she has recognized the presence of a pyretic affection by a sudden rise of 2°–3°, or a steady one from 1°–2° with fluctuations, or that of an apyretic affection by a fall of more than 1°, of which she must carefully note the degrees and fractions at stated times, the first part of her work is ended; she has to transfer her responsibility to the physician she knows most competent to bear it; here her independent action ceases, and my direct advice to her also.

Every physician is alive to the importance of good nursing. No pains, I have repeated, after competent authorities, must be spared to form competent nurses. But when the mother is also the nurse, we owe more to her, who works with us for love, than to strangers, who work under us as a trade. It is my opinion that she has a right to know all that she can understand (I purposely restrict this remark to thermometry) on the manœuvre and use of the surface and fever thermometers; on their application to the present case; on the recording and significance of their reading; on the relations of human temperature with health, disease, and therapeutics; and on the general philosophy of thermometry, as far as her mind can go.

This is not all. Make her love, study, and trust the little magician who, like the little finger in the fairy tale, tells things that nobody can know otherwise. With it she will give us a trusty account of the condition of her patient. During our absence, her hand will be our hand, her eye our eye; and more, seeing a sudden rise or fall of temperature when we are away, she foresees the peril that thermometry predicts several hours in advance, as the barometer does the

storm; her mind becomes our mind, she hastens our return, giving us a chance to ward off a deadly exacerbation or collapse; truly herself saving the life of the patient and eventually our own reputation.

Therefore let us educate women in the arts secondary to ours, and particularly in the handling, recording, and intelligently reading of the operations of the medical thermometers. And when the hours of family trials and of heavy professional responsibilities come, when zymotic or contagious diseases invade the home circle, we have by our side the faithful woman. Neighbors, quacks, and mediums proffer in vain their nostrums; she stands by her thermometer, knowing that a calm and correct record of a day's fever brings more hopes and is a better foundation for a cure than a dishevelled therapeusis.

Less solemn, but not less useful, is the prophylactic home-use of the medical thermometers. I can only give one instance of it: when parents are preparing for an absence, the husband looks at his weather-thermometer to provide extra coverings against the rigors of external temperature, and the mother looks to her medical thermometers to make sure that she does not leave behind, ignored, a bodily temperature foreboding sickness to one of the children, in the next twenty or forty hours.

HEALTH RECORDS.

But mothers, teachers, and physicians as well, need a standard-measure upon which to proportion their action on the young, the sick, the invalid. That standard-measure which we have not and must have, will be found in a Health Record from infancy. This would be broader in its scope than the Prescription and Clinic Record, previously described, which could conveniently be included in it; if it was not better to leave the Health Record under

the charge of the mother, among the private papers of a family, and the Prescription and Clinic Record in the pocket of the physician.

The Health Record would begin, if possible, by the conditions of gestation, birth, nursing, teething, with intercurrent illnesses. Note the time at which the muscular and sensory functions have begun to obey the will and to be co-ordinated; at which the mind passed from the simple perceptive to the duplex reflective state. This done once for all, and as a basis, the Record would register every year, better every season, the general growth and weight, the length and breadth of the principal parts, head, chest, etc. It would be particularly devoted to the keeping of the vital signs; of the progress of muscular contractility; of general and special sensibility as given by physical tests and by positive mensurations, and most particularly to the concordance and discordance of the signs furnished by the circulation, the inspiration, and the temperature. Let us observe, in reference to the latter, that if it be true that the general temperature in health varies but a few tenths, it is not indifferent to know how these variations, ever so small, are brought on; for, if by powerful emotional or circumstancial causes, this shows a constitution eventually capable of reaction against catalytic agencies; but if by slight causes, we must be prepared to find the subject in ulterior sicknesses, without much power of resistance to the morbid process, or reaction towards recovery; in this latter case, a trifling loss of a few tenths of a degree of heat is portentous.

Another order of pyrogenic facts, whose data in health, if properly recorded, insure the ulterior formation of sound medical and educational diagnosis, is that given by the surface thermometers. The data thus furnished refer to the average heat of regions like the head, chest, palm of the hands, and comparatively of the feet, of the epigastri-

um, etc., in the various seasons and under the action of food, exercises, studies, sports, etc.; data of local thermometry which are to be industriously compared with those of general thermometry, of the pulse strokes, sphygmographic waves, spirometric indications, etc.

By the concurrent reading and interpretation of these facts, carefully prepared and registered by the mother, teacher, or family physician, the latter cannot fail to foresee a long way off, in any or several functional disturbances, the coming organic accident, and to stamp it out.

Who of us has not been seized by a feeling like that of giving up at the sight of patients, mostly children, whose enigmatical symptoms cannot be illumined, neither by the unconscious patient nor by the ignorant family? Then twelve lines of records of vital signs, each depicting one year of life, would clear up the dark past, and light up the prognosis and treatment; and thereby, also, how many diseases could be prevented. Families would not be slow to perceive what a saving of time, money, suffering, and lives this Record of Health would afford, and would soon beg their physician to begin his practice with them where it really begins, at the taking of all the details of the physiological diagnosis as a standard-measure of the gravity of ulterior pathological symptoms.

A word more to bind together these apparently isolated suggestions.

The creation of a thermometric scale starting from the physiological temperature of man, zero-health, up to mark fever, exacerbation, etc., down to mark depression, collapse, etc.

The invention of a surface-thermometer to measure by comparison local pyrexias, as the fever-thermometer measures general temperatures, and particularly susceptible to demonstrate the differences of temperature of the temporal

region caused by mental work, concussions, bursts of passion, etc.

The arrangement of a "Prescription and *Clinic Record*," to register the data of thermometry, and of other important methods of diagnosis in the shortest possible time, and whose simplicity and uniformity of plan permits any physician to compare his clinical notes with each other, and with those of his confrères, upon any given subject.

The formation of new tables of temperature and of other vital signs, which require no drawing skill; on which can be grouped all the clinical matters by days and weeks: the latter arrangement by septenaries, offering the much needed opportunity of definitively testing the old doctrine of the "Crises and Critical Days."

The new era open to therapeutics by the power of the thermometer of mathematically measuring the calorific and frigorific action of medicines.

The method of using thermometry and other means of positive diagnosis to predict the extent of capacities for labors of various kinds, the degree of vitality, and the chances of longevity of people who want to enter any active career, and to give or receive guaranties dependent upon their capacity or longevity.

The transfer of the management and training of children to those who know how to husband their vitality expressed by caloricity.

The value of thermometry in the hands of mothers to predict diseases or relapses, to help the physician in the management of the sick, and to protect herself against the assailing suggestions of the ignorant or of the wicked, who hover around a sick-bed like ravens above a corpse.

The necessity for physic, not only to be one of the physical sciences, but to show itself such, by the scientific concordance of its "Records," which permit any physician to

read, criticise, compare, even to continue any observation, or group of observations pertaining to the practice, or to the philosophy of his art, as do physicists and mathematicians.

These suggestions, once brought together by simple "apposition," must already appear what they really were—the intentional parts of an intended plan: the segments of an intellectual cycle.

The segments are the means I have suggested, and the new ones which will soon be offered by other observers to enforce their cohesion.

The cycle is the *ensemble* of the means of substituting positivism for conjecture, authority and credulity in the management of health, disease, education, human solidarity, and social progression.

The type of this cycle could not have been the microscope, notwithstanding its wonders; because its data are not always positive, and it is, so far, too exclusively engaged in analytical investigations; it is the thermometer, which has shown an equal adaptability to the industry of analysis in individual observation, and to the genius of synthesis in the formation of important entities by the creation of several "laws of diseases," but from which much more is expected.

Thermometry will find new laws of disease, new relations of temperature to the various modes of vitality, new standards of observation, and new means of communicating them among physicians. It will extirpate quackery, whose ways cannot stand the light of positive observation, particularly if we give it a scientific and readable unity among ourselves, and if we communicate its rationale to our clients. It will protect legitimate interests founded on vitality, whose claims can be authenticated by means of the instruments of positive diagnosis; it will, in particular, rule the question of Life Insurance.

By keeping a correct record of the phenomena of life in each child, thermometry will take the lead in the management of youth, and particularly in that of national education, assuming as the basis of all the modes and phases of the training, the "indications of the temperature and of the other vital signs," instead of the arbitrary pretensions of literary, scientific, or religious curriculums. The application to practical education of the tests offered by thermometry and by the other means of positive diagnosis, will keep constantly the balance of vitality in favor of the students, thereby improving their beauty and capacity, and soon the æsthetic, social, and working qualities of the race. Here thermometry, as I promised it would, without ceasing to be "medical," becomes "human;" the thermometer opens the way to the most positive application of physiology to the solution of the problems of education; and the prophecy of Descartes will be fulfilled: *if it is possible to improve mankind, physic will give us the means thereof.*

At this point I cannot say a word more without opening a new book, and I stop.

Looking back to the preceding pages, I see the proportions of the responsibility I have incurred, yet do not propose to take advantage of the attenuating circumstances;- whatever could be the verdict, I plead guilty: At the end of a glowing exposition—by its highest interpreter—of what thermometry has done in the last fifteen years, I have attempted to foreshadow what it will accomplish in the next fifteen.

To that effect I have brought together "suggestions" whose contact must project some light upon their subject-matter. But how much? How founded? How serviceable? . . . A man is always the poorest judge of the *qualities* of the products of his own mind. But ideas, like

all other forces, cannot perish. Of those expressed here, some may take root now, and some may dry up with their germs ready for vitalization in other forms, in new combinations, under other names, or other's name.

Whatever may be the issue, I have tried to arouse my medical brethren to the necessity of improving our medical instruments, of giving unity to our methods of diagnosis, and of enlarging our action—the good we can do—to correspond to the wants of modern sociability. If I have failed in one, two, or all the points, I will console myself with the stoic motto of Pierre Corneille:

"J'aurai du moins l'honneur de l'avoir entrepris."

APPENDIX NO. 1.

TABLE OF EQUIVALENTS OF THE CELSIAN (CENTIGRADE), RÉAUMUR'S, FAHRENHEIT'S, AND MEDICAL (SEGUIN'S) THERMOMETERS.

To convert Centigrade into Fahrenheit, multiply by 9, divide by 5, and add 32; or, multiply by 1.8 and add 32.

EXAMPLE:—$20° \times 1.8 + 32 = 68°$ F.

To convert Centigrade into Réaumur, multiply by 4, and divide by 5; or, multiply by 0.8.

EXAMPLE:—$20°$ C. $\times 0.8 = 16°$ R.

To turn Fahrenheit into Centigrade, deduct 32, multiply by 5, and divide by 9.

EXAMPLE:—$104°$ F. $- 32 \times 5 \div 9 = 40°$ C.

To turn Fahrenheit into Réaumur, deduct 32, divide by 9, and multiply by 4.

EXAMPLE:—$104°$ F. $- 32 \div 9 \times 4 = 32°$ R.

To turn Réaumur into Fahrenheit, multiply by 9, divide by 4, and add 32.

To turn Réaumur into Centigrade, multiply by 5, and divide by 4.

To convert Fahrenheit or Réaumur into the Medical Scale, or *vice versa*, reduce them to Centigrade. From Centigrade to Medical the difference of 37° can always be made cursorily without arithmetical operation.

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).
32	0	0	$\overline{37}$	93.38	27.28	34.1	$\overline{2}.9$
41	4	5	$\overline{32}$	93.56	27.36	34.2	$\overline{2}.8$
50	8	10	$\overline{27}$	93.74	27.44	34.3	$\overline{2}.7$
59	12	15	$\overline{22}$	93.92	27.52	34.4	$\overline{2}.6$
63.5	14	17.5	$\overline{19.5}$	94.10	27.60	34.5	$\overline{2}.5$
68	16	20	$\overline{17}$	94.28	27.68	34.6	$\overline{2}.4$
72.5	18	22.5	$\overline{14.5}$	94.46	27.76	34.7	$\overline{2}.3$
77	20	25	$\overline{12}$	94.64	27.84	34.8	$\overline{2}.2$
81.5	22	27.5	$\overline{9.5}$	94.82	27.92	34.9	$\overline{2}.1$
86	24	30	$\overline{7}$	95	28	35	$\overline{2}$
86.9	24.4	30.5	$\overline{6.5}$	95.18	28.8	35.1	$\overline{1}.9$
87.8	24.8	31	$\overline{6}$	95.36	28.16	35.2	$\overline{1}.8$
88.7	25.2	31.5	$\overline{5.5}$	95.54	28.24	35.3	$\overline{1}.7$
89.6	25.6	32	$\overline{5}$	95.72	28.32	35.4	$\overline{1}.6$
90.5	26	32.5	$\overline{4.5}$	95.90	28.40	35.5	$\overline{1}.5$
90.68	26.08	32.6	$\overline{4.4}$	96.08	28.48	35.6	$\overline{1}.4$
90.86	26.16	32.7	$\overline{4.3}$	96.26	28.56	35.7	$\overline{1}.3$
91.04	26.24	32.8	$\overline{4.2}$	96.44	28.64	35.8	$\overline{1}.2$
91.22	26.32	32·9	$\overline{4.1}$	96.62	28.72	35.9	$\overline{1}.1$
91.40	26.4	33	$\overline{4}$	96.80	28.80	36	$\overline{1}$
91.58	26.48	33.1	$\overline{3.9}$	96.98	28.88	36.1	$\overline{.9}$
91.76	26.56	33.2	$\overline{3.8}$	97.16	28.96	36.2	$\overline{.8}$
91.94	26.64	33.3	$\overline{3.7}$	97.25	29	36.25	$\overline{.75}$
92.12	26.72	33.4	$\overline{3.6}$	97.34	29.4	36·3	$\overline{.7}$
92.30	26.80	33.5	$\overline{3.5}$	97.52	29.12	36.4	$\overline{.6}$
92.48	26.88	33.6	$\overline{3.4}$	97.70	29.20	36.5	$\overline{.5}$
92.66	26.96	33.7	$\overline{3.3}$	97.88	29.28	36.6	$\overline{.4}$
92.84	27.4	33.8	$\overline{3.2}$	98.06	29.36	36.7	$\overline{.3}$
93.02	27.12	33.9	$\overline{3.1}$	98.15	29.40	36.75	$\overline{.25}$
93.20	27.20	34	$\overline{3}$	98.24	29.44	36.8	$\overline{.2}$

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).
98.42	29.52	36.9	.1	102.74	31.44	39.3	2.3
98.60	29.60	37	0	102.875	31.48	39.35	2.35
98.78	29.68	37.1	.1	102.92	31.52	39.4	2.4
98.96	29.76	37.2	.2	103.10	31.60	39.5	2.5
98.05	29.80	37.25	.25	103.28	31.68	39.6	2.6
99.14	29.84	37.3	.3	103.46	31.76	39.7	2.7
99.32	29.92	37.4	.4	103.55	31.80	39.75	2.75
99.50	30	37.5	.5	103.64	31.84	39.8	2.8
99.68	30.08	37.6	.6	103.82	31.92	39.9	2.9
99.86	30.16	37.7	.7	104	32	40	3
99.95	30.20	37.75	.75	104.18	32.08	40.1	3.1
100.4	30.24	37.8	.8	104.36	32.16	40.2	3.2
100.22	30.32	37.9	.9	104.45	32.20	40.25	3.25
100.40	30.40	38	1	104.54	32.24	40.3	3.3
100.58	30.48	38.1	1.1	104.72	32.32	40.4	3.4
100.67	30.52	38.25	1.15	104.90	32.40	40.5	3.5
100.76	30.56	38.20	1.20	105.108	32.48	40.6	3.6
100.85	30.60	38.25	1.25	105.125	32.52	40.625	3.625
100.94	30.64	38.3	1.3	105.26	32.56	40.7	3.7
101.12	30.72	38.4	1.4	105.37	32.60	40.75	3.75
101.30	30.80	38.5	1.5	105.44	32.64	40.8	3.8
101.48	30.88	38.6	1.6	105.62	32.72	40.9	3.9
101.66	30.96	38.7	1.7	105.80	33.80	41	4
101.75	31	38.75	1.75	105.98	32.88	41.1	4.1
101.84	31.4	38.8	1.8	106.025	32.92	41.125	4.125
102.02	31.12	38.9	1.9	106.16	32.96	41.2	4.2
102.20	31.20	39	2	106.25	33	41.25	4.25
102.38	31.28	39.1	2.1	106.34	33.04	41.3	4.3
102.56	31.36	39.2	2.2	106.52	33.12	41.4	4.4
102.65	31.40	39.25	2.25	106.70	33.20	41.5	4.5

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Seguin (Medical).
106.88	33.28	41.6	4.6	109.625	34.5	43.125	6.125
106.925	33.32	41.625	4.625	109.76	34.56	43.2	6.2
107.06	33.36	41.7	4.7	109.85	34.6	43.25	6.25
107.15	33.40	41.75	4.75	109.94	34.64	43.3	6.3
107.24	33.44	41.8	4.8	110.075	34.7	43.375	6.375
107.375	33.50	41.825	4.825	110.12	34.72	43.4	6.4
107.42	33.52	41.9	4.9	110.30	34.8	43.5	6.5
107.60	33.60	42	5	110.48	34.88	43.6	6.6
107.78	33.68	42.1	5.1	110.525	34.9	43.625	6.625
107.825	33.70	42.125	5.125	110.66	34.96	43.7	6.7
107.96	33.76	42.2	5.2	110.75	35	43.75	6.75
108.05	33.80	42.25	5.25	110.84	35.04	43.8	6.8
108.14	33.84	42.3	5.3	111.02	35.12	43.9	6.9
108.185	33.90	42.375	5.375	111.20	35.20	44	7
108.32	33.92	42.4	5.4	111.38	35.28	44.1	7.1
108.05	34	42.5	5.5	111.56	35.36	44.2	7.2
108.68	34.08	42.6	5.6	111.74	35.44	44.3	7.3
108.725	34.1	42.625	5.625	111.875	35.5	44.375	7.375
108.86	34.16	42.7	5.7	111.92	35.52	44.4	7.4
108.95	34.20	42.75	5.75	112.1	35.6	44.5	7.5
109.04	34.24	42.8	5.8	112.28	35.68	44.6	7.6
109.175	34.3	42.875	5.875	112.46	35.76	44.7	7.7
109.22	34.32	42.9	5.9	112.64	35.84	44.8	7.8
109.40	34.4	43	6	112.82	35.92	44.9	7.9
109.58	34.48	43.1	6.1	113.	36	45	8

APPENDIX NO. II.

PRESCRIPTION AND CLINICAL RECORD.

Its Object:—1. To show a physician daily what he does, and how every one of his patients does.

2. To give more precision and certainty to prescriptions by writing them twice—once for keeping, and once for the apothecary.

3. To give the most minute details of their practice an indisputable authenticity in the courts of justice.

4. To substitute, more and more, positivism for conjecture in diagnosis and prognosis.

5. To record phenomena on the spot in no time, and keep their series in sight.

6. To treat complex or protracted cases with scientific unity of plan.

7. To enable a physician to continue, with perfect knowledge, the treatment of the case of a *confrère*, absent or sick.

8. To lay the foundations of true monographs, and prepare reliable statistics.

9. To compare, at a glance, with other practitioners, the medical constitution of various localities.

10. To keep the physicians posted on the use of improved instruments of medical diagnosis, as surgeons generally are in regard to those of their art.

11. To measure mathematically the vital forces at any given time; also the effects of electricity and tetanic remedies on the principal functions.

12. To sum up, at any time, their business by the number of Records used; each containing 100 prescription sheets.

Its Contents:—The first part of this pocket-book is calculated to obviate the effects of the hurry inherent to medical practice, by a stringent and rapid systemization.

The second part is mostly devoted to the illustration of the instruments and methods of *positive diagnosis*, serviceable to extend, complete, or correct the notions of our senses.

[Few men can soar above all questions and solve them all at a glance. The great majority of conscientious practitioners dispassionately interrogate their senses before forming an opinion, and knowing that the senses are imperfect, or their operations often interfered with by preconceptions of the mind, they like to avail themselves of the instruments recently contrived to help the senses to perceive. These are of two classes. 1. The instruments of *physical* diagnosis,—stethoscope, ophthalmoscope, specula, etc., which give a further reach to our senses. 2. The instruments of *positive* diagnosis,—thermometer, dynamometer, etc., which give sensorial results susceptible of mathematical measurements. Where the other signs are uncertain, those furnished by *positive* diagnosis dispel uncertainty, being sure premises to a sound judgment. Therefore we will spare no trouble or expense to bring forward the most recent and approved instruments of *positive* diagnosis.]

The last pages are arranged to group facts in regard to temperature, medical constitution, epidemics, etc., permitting physicians of different wards or regions to compare these data, improve their practice, enlarge their views, and prepare important generalizations.

Hoping that the plan of this hand-book will meet the want of systemization now felt in all human labors, and in ours as much as in any other, we will modify it from time to time, to keep pace with acknowledged improvements, and in compliance with the advice (respectfully solicited here) of the progressive minds of the profession.

APPENDIX NO. III.

NOTE ON THE HEAT PRODUCED BY ANIMALS, AND THEIR RESISTANCE TO ATMOSPHERIC DIFFERENCES OF TEMPERATURE.

We have seen the fœtus warmer than its mother. All animals have, like man, their normal temperature, capable of resisting the action of external heat or cold. Here are subjoined, from Gavaret, Valentin, etc., tables of temperature of different classes and species of animals, showing that their degree of resistance to cold is very much in proportion to the perfection of their organization. This reminds us that the vital laws have not been made for man separately from animals. The law of resistance of animals to their ambient atmosphere applies to man mainly in this, that man cannot evolve more heat than is shown by his norme without endangering his life. This is said for teachers as well as for physicians, and demonstrated by the following tables.

Tables of Temperature of Birds.

	° Cent.
Petrel	40.30–40.80
Parrot	41.10
Goose	41.70
Jackdaw	42.10
Screech-owl	41.47
Heron	41.
Sparrow	41.67–42.10
Yellow Hammer	42.88

	° Cent.
Tiercelet	41.47
Pigeon	41.80–43.30
Cock	39.44–40.
Turkey-cock	42.70
Moor-hen	42.00–42.50
Guinea Fowl	43.90
Common Fowl	39.44–43.90
Thrush	42.80
Common Duck	42.50–43.90
Crow	41.17
Raven	42.91

The Temperature of Mammifers.

	° Cent.
French Horse	36.80
Arabian Horse	37.50
Common Rat	38.80
Common Hare	37.80
Tiger	37.20
Common Cat	38.30–38.90
Squirrel	38.80
Panther	38.90
Dog	37.40–39.60
Elk (female)	39.40
Monkey	35.50–39.70
Sheep	37.30–40.50
Ichneumon	39.40
She-goat	40.
He-goat (castrated)	39.50
She-ass	37.98
He-ass	37.95
Jackal	38.50

	° Cent.
Ox	37.50
Capibara	35.76–39.
Rabbit	37.50–40.
Porpoise	35.62–37.80
Sea-cow	38.89–40.

The temperature of man oscillates between 36.50° and 37.50° ; averages 37°.

Excess of Temperature of Reptiles over that of their Surrounding Atmosphere.

	° Cent.
Viper	5.06
Toad	0.50–2.80
Frog	0.04–4.44
Iguana	1.22
Boa	2.50
Lizard	0.75–1.25
Adder	1.35–3.90
Turtle	1.22–3.90

The Excess of Temperature of Fishes over that of their Surrounding Atmosphere.

	° Cent.
Pike	3.88
Carp	0.36–3.
Eel	0.93
Tench	0.50–0 71
Shark	1.30
Trout	0.55–1.10
Ablet	0.55

THE EXCESS OF TEMPERATURE OF ARTICULATA AND ANNELIDES OVER THAT OF THEIR SURROUNDING ATMOSPHERE.

	° CENT.
Beetles	0.25–0.70
Glow-worm	0.50
Ground-worm	1.11–1.39
Silk-worm	1.
Larvæ of Sphinx	1.66
Coccinella	0.44
Gryllus	0.31–0.94
Scarabæus Vernalis	0.12–0.18
Leech	0.56–0.85

THE EXCESS OF TEMPERATURE IN LOWER ANIMALS OVER THAT OF THEIR SURROUNDING ATMOSPHERE.

	° CENT.
Crustacea	0.60
Cephalopods	0.57
Molluscs	0.46
Echinoderms	0.40
Meduses	0.27
Polyps	0.21

SUMMARY

OF

DR. E. SEGUIN'S SUGGESTIONS ON THERMOMETRY AND HUMAN TEMPERATURE.

PAGE

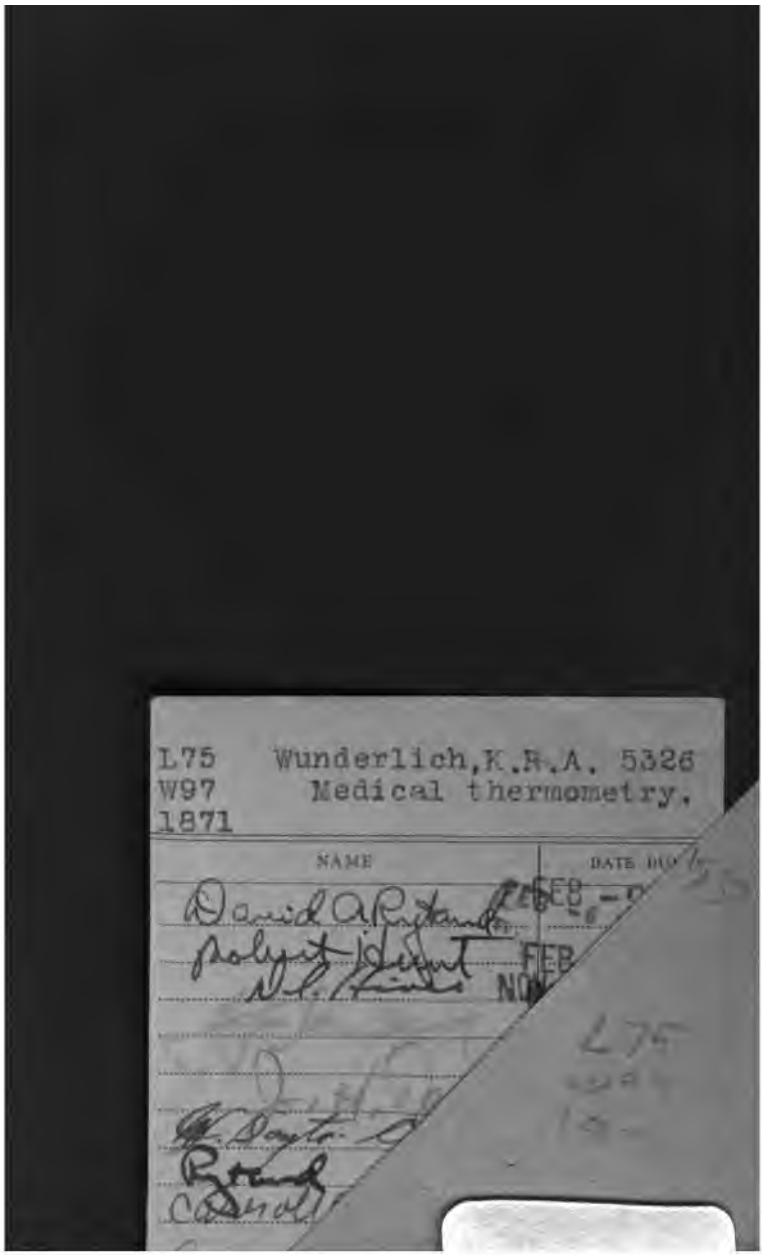
Present position of Medical Thermometry 198
Prospects of Medical Thermometry 199
Hand-thermometry 201
Education of the Medical Senses 202
Thermometers made self-registering by Dr. Aitken 203
The thermometers of physicists 204
Attempts at improvements of thermometers by L. Casella 204
Human temperature 206
Its norme found by Brechet 206
Human thermometry founded upon this norme 206
The health-point taken for zero-temperature 206
Fever-thermometer 208
Its application and reading 209
Taught to nurses 210
Surface-thermometers 211
their construction and manœuvre 212
in what cases they can be used 214
Table of registration of temperature 216
of other vital signs and of septenaries 218
Doctrine of the crises and critical days 219
Medical theurgism 220
Hospital records of the Asclepiades 221
Philosophical and clinical foundation of the doctrine of the crises .. 222
Testimony of Hippocrates in favor of it 222
Concordance of the results of this ancient dogma, with the facts obtained by thermometry 223
Hippocrates and Wunderlich 224
Conclusions to be drawn from the comparison 232
Importance of uniformity in the modes of taking medical observations 232
How to obtain this uniformity 233

PAGE
The Prescription and Clinic Record..... 234
Solution of the problem of the critical days..... 235
Thermometry ruling therapeutics..... 237
Concurrence of other methods of observation with thermometry... 238
Concurrence with the other great vital signs..... 239
Significance of the concordance and of the discordance of the three great vital signs..... 240
Concurrence of thermometry with the physical means of diagnosis. 242
Same concurrence with the positive means of diagnosis..... 243
How thereby the field of thermometry is enlarged..... 244
Application of thermometry to business or social purposes..... 245
to Life Insurance Companies..... 246
to the prevention of constitutional affections during the growth period.. 249
Examples from osseous degenerescences..... 251
from muscular decroit..... 252
from nervous incapacitation..... 253
How many ways of starving the youth..... 254
Pyrexic laws of animals..... 255
Application of these laws to education..... 255
to the motherly management of children. 256
Medical education of mothers..... 257
How to develop their natural capacity for nursing..... 258
A record of health due to each child and to the progress of our art. 261
How thermometry elevates and enlarges the standard of the medical profession..... 263
Conclusions..... 265
Tables of equivalents of the various thermometers..... 268
Plan of a clinical record for private practice..... 273
Tables of comparison of the temperature of animals, by classes.... 275

LANE MEDICAL LIBRARY

To avoid fine, this book should be returned
on or before the date last stamped below.

-9 1932
3 15 1932
OV 21 1933
JAN 31 1938
EC -9 1938
B -9 1939
24 1939
20 1963
N 27 1964
OCT 2 6 1966
JUN 1 6 1982


L75
W97
1871
Wunderlich,K.R.A. 5326
Medical thermometry.
NAME
DATE
FEB
FEB
L75